

# NetXMS Communication Protocol

## Reference Guide

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# 1. Introduction

NetXMS Communication Protocol (NXCP) is a protocol used by all NetXMS entities (server, agents, clients) for communications. Protocol is message-oriented and designed to work on top of TCP protocol.

## 2. Message Format

### 2.1. Message Structure

Message in NXCP consists of a header and an optional payload which follows header immediately. Padding bytes can be added at the end of a message to make it aligned to 8-bytes boundary. Here is general message structure:

Header 16 bytes	Payload 0 – 256K bytes	Padding 0-7 bytes
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### 2.2. Message Header

Header have the following format:

Field	Size (bytes)	Meaning
CODE	2	Command code. List of well-known command codes can be found in Appendix A.
FLAGS	2	Flags – see explanation below
SIZE	4	Size of a message in bytes, including header and padding
ID	4	Message identifier (usually used to match replies to requests)
DF_COUNT	4	Number of data fields or size of raw data, depending on flags

In the FLAGS field, the following bit flags (or combination of them) can be used:

Flag	Value	Meaning
BINARY	0x0001	Message contains raw binary data instead of structured data fields. If this flag is set, DF_COUNT contains size of raw data in bytes.
END_OF_FILE	0x0002	For file transfer operations, indicates that message contains last part of a file.
DONT_ENCRYPT	0x0004	Used internally by libnetxms to indicate that message should not be encrypted on sending. Has no meaning for the receiver.
END_OF_SEQUENCE	0x0008	Indicates that message contains last portion of data.
REVERSE_ORDER	0x0010	Indicates that data coming in a set of messages will arrive in reverse order (event log records, for example).
CONTROL	0x0020	Indicates control message. Control messages doesn't contain payload part, and header fields may have special meaning. See below for detailed control messages list.

All fields have network byte order.

## 2.3. Data Element (Variable)

Structured message's payload consist of one or more data elements, or variables. Each variable has the following structure:

Variable ID 4 bytes	Data Type 1 byte	Padding 1 byte	Data 0-256K bytes (depending on data type)	Padding 0-7 bytes
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Size of each element should be a multiplier of 8, so up to 7 padding bytes can be appended as necessary.

Variable ID is a unique identifier of a variable in a message scope. List of well-known message ID's can be found in Appendix B.

Data type can be one of the following:

Symbolic name	Value	Description
INTEGER	0	32-bit integer value
STRING	1	String value
INT64	2	64-bit integer value
INT16	3	16-bit integer value
BINARY	4	Raw binary data
FLOAT	5	64-bit floating point value

All numeric values have network byte order.

Actual format of data filed determined by variable's data type – see below.

### INTEGER

Padding 2 bytes	Integer value (32-bit) 4 bytes
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### STRING

Padding 2 bytes	Length 4 bytes	Content 0 – 256K bytes
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Strings encoded in two-byte UNICODE (UCS-2), with network byte order. Length specified in bytes.

**INT64**

Padding 2 bytes	Integer value (64-bit) 8 bytes
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**INT16**

Integer value (16-bit) 2 bytes
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**BINARY**

Padding 2 bytes	Length 4 bytes	Content 0 – 256K bytes
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**FLOAT**

Padding 2 bytes	Floating point value (64-bit) 8 bytes
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## 3. Client-Server Communications

### 3.1. General Description

Communication session between client and server always initiated by client. All messages can be divided into three categories – request, response, and notification. Request messages sent by client to ask server for information or to instruct it to do something. Server replies with response messages, which usually contains request completion code and, depending on request, some additional data. If amount of data to be transferred is large, server may send many response messages to one request. Server may also send notification messages to inform client about various events – for example, change in object's status.

### 3.2. Typical client-server session scenario

Usually client-server communication session looks as following:

Client message	Server message
CMD_GET_SERVER_INFO	
	CMD_REQUEST_COMPLETED
CMD_LOGIN	
	CMD_LOGIN_RESP
Data request or command	
	CMD_REQUEST_COMPLETED
...	

### 3.3. Request messages

#### 3.3.1. CMD\_GET\_SERVER\_INFO

Get server information.

Response: CMD\_REQUEST\_COMPLETED

#### 3.3.2. CMD\_KEEPLIVE

This message only cause server to immediately respond with successful request completion message. It can be used to check connectivity with server or to prevent current connection from timing out.

Response: CMD\_REQUEST\_COMPLETED

### 3.3.3. CMD\_LOGIN

Perform user login.

Variables

Variable	Type	Description
VID_LOGIN_NAME	STRING	Login name
VID_AUTH_TYPE	INT16	Authentication type: 0 for password authentication or 1 for authentication by certificate
VID_PASSWORD	STRING	Password (ignored if authentication type is 1)
VID_SIGNATURE	BINARY	User's signature – server's challenge encrypted with user's private key (ignored if authentication type is 0)
VID_CERTIFICATE	BINARY	User's certificate (ignored if authentication type is 0)
VID_CLIENT_INFO	STRING	Client application name and version
VID_OS_INFO	STRING	OS name and version (like WinNT 5.0)
VID_LIBNXCL_VERSION	STRING	Version of libnxcl

Response: CMD\_LOGIN\_RESP

## 3.4. Response Messages

### 3.4.1. CMD\_REQUEST\_COMPLETED

Generic response message – used as a response to most of the requests.

Variables

Variable	Type	Description
VID_RCC	INTEGER	Request completion code. For list of possible codes see Appendix C.
VID_LOCKED_BY	STRING	Current lock owner. Valid only if VID_RCC is set to RCC_COMPONENT_LOCKED.

Additional variables used only in response to CMD\_GET\_SERVER\_INFO message

Variable	Type	Description
VID_SERVER_ID	BINARY	8-byte server identifier.
VID_SERVER_VERSION	STRING	Server version string.
VID_PROTOCOL_VERSION	INTEGER	Client-server protocol version.

### 3.4.2. CMD\_LOGIN\_RESP

Response message for login request (CMD\_LOGIN).



## Variables

Variable	Type	Description
VID_RCC	INTEGER	Request completion code. For list of possible codes see Appendix C.
VID_USER_ID	INTEGER	User ID of logged in user.
VID_USER_SYS_RIGHTS	INTEGER	System-wide access rights for logged in user.
VID_CHANGE_PASSWD_FLAG	INT16	Password change flag – will be set to non-zero if user should change password.
VID_DBCONN_STATUS	INT16	Status of connection between server and backend database – will be set to non-zero value if backend database connection has problems.

## Appendix A. Well-known Message Codes

Symbolic name	Value
CMD_LOGIN	0x0001
CMD_LOGIN_RESP	0x0002
CMD_KEEPALIVE	0x0003
CMD_EVENT	0x0004
CMD_GET_OBJECTS	0x0005
CMD_OBJECT	0x0006
CMD_DELETE_OBJECT	0x0007
CMD_MODIFY_OBJECT	0x0008
CMD_OBJECT_LIST_END	0x0009
CMD_OBJECT_UPDATE	0x000A
CMD_GET_EVENTS	0x000B
CMD_EVENT_LIST_END	0x000C
CMD_GET_CONFIG_VARLIST	0x000D
CMD_SET_CONFIG_VARIABLE	0x000E
CMD_GET_OBJECT_TOOLS	0x000F
CMD_EXECUTE_ACTION	0x0010
CMD_DELETE_CONFIG_VARIABLE	0x0011
CMD_NOTIFY	0x0012
CMD_TRAP	0x0013
CMD_OPEN_EPP	0x0014
CMD_CLOSE_EPP	0x0015
CMD_SAVE_EPP	0x0016
CMD_EPP_RECORD	0x0017
CMD_LOCK_EVENT_DB	0x0018
CMD_UNLOCK_EVENT_DB	0x0019

CMD_SET_EVENT_INFO	0x001A
CMD_EVENT_DB_RECORD	0x001B
CMD_LOAD_EVENT_DB	0x001C
CMD_REQUEST_COMPLETED	0x001D
CMD_LOAD_USER_DB	0x001E
CMD_USER_DATA	0x001F
CMD_GROUP_DATA	0x0020
CMD_USER_DB_EOF	0x0021
CMD_UPDATE_USER	0x0022
CMD_DELETE_USER	0x0023
CMD_CREATE_USER	0x0024
CMD_LOCK_USER_DB	0x0025
CMD_UNLOCK_USER_DB	0x0026
CMD_USER_DB_UPDATE	0x0027
CMD_SET_PASSWORD	0x0028
CMD_GET_NODE_DCI_LIST	0x0029
CMD_NODE_DCI	0x002A
CMD_NODE_DCI_LIST_END	0x002B
CMD_DELETE_NODE_DCI	0x002C
CMD_MODIFY_NODE_DCI	0x002D
CMD_UNLOCK_NODE_DCI_LIST	0x002E
CMD_SET_OBJECT_MGMT_STATUS	0x002F
CMD_CREATE_NEW_DCI	0x0030
CMD_GET_DCI_DATA	0x0031
CMD_DCI_DATA	0x0032
CMD_GET_MIB_TIMESTAMP	0x0033
CMD_GET_MIB	0x0034
CMD_REQUEST_NEW_LPP_ID	0x0035

CMD_OPEN_LPP	0x0036
CMD_CREATE_OBJECT	0x0037
CMD_GET_EVENT_NAMES	0x0038
CMD_EVENT_NAME_LIST	0x0039
CMD_BIND_OBJECT	0x003A
CMD_UNBIND_OBJECT	0x003B
CMD_GET_IMAGE_LIST	0x003C
CMD_LOAD_IMAGE_FILE	0x003D
CMD_IMAGE_LIST	0x003E
CMD_IMAGE_FILE	0x003F
CMD_AUTHENTICATE	0x0040
CMD_GET_PARAMETER	0x0041
CMD_GET_LIST	0x0042
CMD_ACTION	0x0043
CMD_GET_DEFAULT_IMAGE_LIST	0x0044
CMD_DEFAULT_IMAGE_LIST	0x0045
CMD_GET_ALL_ALARMS	0x0046
CMD_GET_ALARM	0x0047
CMD_ACK_ALARM	0x0048
CMD_ALARM_UPDATE	0x0049
CMD_ALARM_DATA	0x004A
CMD_DELETE_ALARM	0x004B
CMD_LOCK_ACTION_DB	0x004C
CMD_UNLOCK_ACTION_DB	0x004D
CMD_LOAD_ACTIONS	0x004E
CMD_ACTION_DB_UPDATE	0x004F
CMD_MODIFY_ACTION	0x0050
CMD_CREATE_ACTION	0x0051

CMD_DELETE_ACTION	0x0052
CMD_ACTION_DATA	0x0053
CMD_GET_CONTAINER_CAT_LIST	0x0054
CMD_CONTAINER_CAT_DATA	0x0055
CMD_DELETE_CONTAINER_CAT	0x0056
CMD_CREATE_CONTAINER_CAT	0x0057
CMD_MODIFY_CONTAINER_CAT	0x0058
CMD_POLL_NODE	0x0059
CMD_POLLING_INFO	0x005A
CMD_COPY_DCI	0x005B
CMD_WAKEUP_NODE	0x005C
CMD_DELETE_EVENT_TEMPLATE	0x005D
CMD_GENERATE_EVENT_CODE	0x005E
CMD_LOCK_TRAP_CFG	0x005F
CMD_UNLOCK_TRAP_CFG	0x0060
CMD_CREATE_TRAP	0x0061
CMD_MODIFY_TRAP	0x0062
CMD_DELETE_TRAP	0x0063
CMD_LOAD_TRAP_CFG	0x0064
CMD_TRAP_CFG_RECORD	0x0065
CMD_QUERY_PARAMETER	0x0066
CMD_GET_SERVER_INFO	0x0067
CMD_SET_DCI_STATUS	0x0068
CMD_FILE_DATA	0x0069
CMD_TRANSFER_FILE	0x006A
CMD_UPGRADE_AGENT	0x006B
CMD_GET_PACKAGE_LIST	0x006C
CMD_PACKAGE_INFO	0x006D

CMD_REMOVE_PACKAGE	0x006E
CMD_INSTALL_PACKAGE	0x006F
CMD_LOCK_PACKAGE_DB	0x0070
CMD_UNLOCK_PACKAGE_DB	0x0071
CMD_ABORT_FILE_TRANSFER	0x0072
CMD_CHECK_NETWORK_SERVICE	0x0073
CMD_GET_AGENT_CONFIG	0x0074
CMD_UPDATE_AGENT_CONFIG	0x0075
CMD_GET_PARAMETER_LIST	0x0076
CMD_DEPLOY_PACKAGE	0x0077
CMD_INSTALLER_INFO	0x0078
CMD_GET_LAST_VALUES	0x0079
CMD_APPLY_TEMPLATE	0x007A
CMD_SET_USER_VARIABLE	0x007B
CMD_GET_USER_VARIABLE	0x007C
CMD_ENUM_USER_VARIABLES	0x007D
CMD_DELETE_USER_VARIABLE	0x007E
CMD_ADM_MESSAGE	0x007F
CMD_ADM_REQUEST	0x0080
CMD_CHANGE_IP_ADDR	0x0081
CMD_REQUEST_SESSION_KEY	0x0082
CMD_ENCRYPTED_MESSAGE	0x0083
CMD_SESSION_KEY	0x0084
CMD_REQUEST_ENCRYPTION	0x0085
CMD_GET_ROUTING_TABLE	0x0086
CMD_EXEC_TABLE_TOOL	0x0087
CMD_TABLE_DATA	0x0088
CMD_APPLY_LOG_POLICY	0x0089

CMD_CHANGE_SUBSCRIPTION	0x008A
CMD_GET_SYSLOG	0x008B
CMD_SYSLOG_RECORDS	0x008C
CMD_GET_LPP_LIST	0x008D
CMD_OPEN_LOG_POLICY	0x008E
CMD_CLOSE_LOG_POLICY	0x008F
CMD_GET_OBJECT_TOOL_DETAILS	0x0090
CMD_LOCK_OBJECT_TOOLS	0x0091
CMD_UNLOCK_OBJECT_TOOLS	0x0092
CMD_UPDATE_OBJECT_TOOL	0x0093
CMD_DELETE_OBJECT_TOOL	0x0094
CMD_SETUP_PROXY_CONNECTION	0x0095
CMD_GENERATE_OBJECT_TOOL_ID	0x0096
CMD_GET_SERVER_STATS	0x0097
CMD_GET_SCRIPT_LIST	0x0098
CMD_GET_SCRIPT	0x0099
CMD_UPDATE_SCRIPT	0x009A
CMD_DELETE_SCRIPT	0x009B
CMD_RENAME_SCRIPT	0x009C
CMD_GET_SESSION_LIST	0x009D
CMD_KILL_SESSION	0x009E
CMD_GET_TRAP_LOG	0x009F
CMD_TRAP_LOG_RECORDS	0x00A0
CMD_START_SNMP_WALK	0x00A1
CMD_SNMP_WALK_DATA	0x00A2
CMD_GET_MAP_LIST	0x00A3
CMD_LOAD_MAP	0x00A4
CMD_SAVE_MAP	0x00A5

CMD_DELETE_MAP	0x00A6
CMD_RESOLVE_MAP_NAME	0x00A7
CMD_SUBMAP_DATA	0x00A8
CMD_UPLOAD_SUBMAP_BK_IMAGE	0x00A9
CMD_GET_SUBMAP_BK_IMAGE	0x00AA
CMD_GET_MODULE_LIST	0x00AB
CMD_UPDATE_MODULE_INFO	0x00AC
CMD_COPY_USER_VARIABLE	0x00AD
CMD_RESOLVE_DCI_NAMES	0x00AE
CMD_GET_MY_CONFIG	0x00AF
CMD_GET_AGENT_CFG_LIST	0x00B0
CMD_OPEN_AGENT_CONFIG	0x00B1
CMD_SAVE_AGENT_CONFIG	0x00B2
CMD_DELETE_AGENT_CONFIG	0x00B3
CMD_SWAP_AGENT_CONFIGS	0x00B4
CMD_TERMINATE_ALARM	0x00B5
CMD_GET_NXCP_CAPS	0x00B6
CMD_NXCP_CAPS	0x00B7
CMD_GET_OBJECT_COMMENTS	0x00B8
CMD_UPDATE_OBJECT_COMMENTS	0x00B9
CMD_ENABLE_AGENT_TRAPS	0x00BA
CMD_PUSH_DCI_DATA	0x00BB
CMD_GET_ADDR_LIST	0x00BC
CMD_SET_ADDR_LIST	0x00BD
CMD_RESET_COMPONENT	0x00BE
CMD_GET_DCI_EVENTS_LIST	0x00BF
CMD_CREATE_MGMT_PACK	0x00C0
CMD_INSTALL_MGMT_PACK	0x00C1



CMD_GET_TRAP_CFG_RO	0x00C2
CMD_SNMP_REQUEST	0x00C3
CMD_GET_DCI_INFO	0x00C4
CMD_GET_GRAPH_LIST	0x00C5
CMD_DEFINE_GRAPH	0x00C6
CMD_DELETE_GRAPH	0x00C7
CMD_GET_SYSTEM_DCI_LIST	0x00C8
CMD_ADD_CA_CERTIFICATE	0x00C9
CMD_DELETE_CERTIFICATE	0x00CA
CMD_GET_CERT_LIST	0x00CB
CMD_UPDATE_CERT_COMMENTS	0x00CC
CMD_QUERY_L2_TOPOLOGY	0x00CD
CMD_AUDIT_RECORD	0x00CE
CMD_GET_AUDIT_LOG	0x00CF

## Appendix B. Well-known Variable Codes

Symbolic name	Value
VID_LOGIN_NAME	1
VID_PASSWORD	2
VID_OBJECT_ID	3
VID_OBJECT_NAME	4
VID_OBJECT_CLASS	5
VID_SNMP_VERSION	6
VID_PARENT_CNT	7
VID_IP_ADDRESS	8
VID_IP_NETMASK	9
VID_OBJECT_STATUS	10
VID_IF_INDEX	11
VID_IF_TYPE	12
VID_FLAGS	13
VID_CREATION_FLAGS	14
VID_AGENT_PORT	15
VID_AUTH_METHOD	16
VID_SHARED_SECRET	17
VID_COMMUNITY_STRING	18
VID_SNMP_OID	19
VID_NAME	20
VID_VALUE	21
VID_PEER_GATEWAY	22
VID_NOTIFICATION_CODE	23
VID_EVENT_CODE	24
VID_SEVERITY	25

VID_MESSAGE	26
VID_DESCRIPTION	27
VID_RCC	28
VID_LOCKED_BY	29
VID_IS_DELETED	30
VID_CHILD_CNT	31
VID_ACL_SIZE	32
VID_INHERIT_RIGHTS	33
VID_USER_NAME	34
VID_USER_ID	35
VID_USER_SYS_RIGHTS	36
VID_USER_FLAGS	37
VID_NUM_MEMBERS	38
VID_IS_GROUP	39
VID_USER_FULL_NAME	40
VID_USER_DESCRIPTION	41
VID_UPDATE_TYPE	42
VID_DCI_ID	43
VID_POLLING_INTERVAL	44
VID_RETENTION_TIME	45
VID_DCI_SOURCE_TYPE	46
VID_DCI_DATA_TYPE	47
VID_DCI_STATUS	48
VID_MGMT_STATUS	49
VID_MAX_ROWS	50
VID_TIME_FROM	51
VID_TIME_TO	52
VID_DCI_DATA	53

VID_NUM_THRESHOLDS	54
VID_DCI_NUM_MAPS	55
VID_DCI_MAP_IDS	56
VID_DCI_MAP_INDEXES	57
VID_NUM_MIBS	58
VID_MIB_NAME	59
VID_MIB_FILE_SIZE	60
VID_MIB_FILE	61
VID_COMMENT	62
VID_ALARM_SEVERITY	63
VID_ALARM_KEY	64
VID_ALARM_TIMEOUT	65
VID_ALARM_MESSAGE	66
VID_RULE_ID	67
VID_NUM_SOURCES	68
VID_NUM_EVENTS	69
VID_NUM_ACTIONS	70
VID_RULE_SOURCES	71
VID_RULE_EVENTS	72
VID_RULE_ACTIONS	73
VID_NUM_RULES	74
VID_CATEGORY	75
VID_UPDATED_CHILD_LIST	76
VID_EVENT_NAME_TABLE	77
VID_PARENT_ID	78
VID_CHILD_ID	79
VID_IMAGE_ID	80
VID_NUM_IMAGES	81

VID_COMMENTS	82
VID_IMAGE_FILE_SIZE	83
VID_IMAGE_FILE	84
VID_PARAMETER	85
VID_NUM_STRINGS	86
VID_ACTION_NAME	87
VID_NUM_ARGS	88
VID_IMAGE_ID_LIST	89
VID_CLASS_ID_LIST	90
VID_IMAGE_FORMAT	91
VID_NOTIFICATION_DATA	92
VID_ALARM_ID	93
VID_TIMESTAMP	94
VID_ACK_BY_USER	95
VID_IS_ACK	96
VID_ACTION_ID	97
VID_IS_DISABLED	98
VID_ACTION_TYPE	99
VID_ACTION_DATA	100
VID_EMAIL_SUBJECT	101
VID_RCPT_ADDR	102
VID_CATEGORY_NAME	103
VID_CATEGORY_ID	104
VID_DCI_DELTA_CALCULATION	105
VID_DCI_FORMULA	106
VID_POLL_TYPE	107
VID_POLLER_MESSAGE	108
VID_SOURCE_OBJECT_ID	109

VID_DESTINATION_OBJECT_ID	110
VID_NUM_ITEMS	111
VID_ITEM_LIST	112
VID_MAC_ADDR	113
VID_TEMPLATE_VERSION	114
VID_NODE_TYPE	115
VID_INSTANCE	116
VID_TRAP_ID	117
VID_TRAP_OID	118
VID_TRAP_OID_LEN	119
VID_TRAP_NUM_MAPS	120
VID_SERVER_VERSION	121
VID_SUPPORTED_ENCRYPTION	122
VID_EVENT_ID	123
VID_AGENT_VERSION	124
VID_FILE_NAME	125
VID_PACKAGE_ID	126
VID_PACKAGE_VERSION	127
VID_PLATFORM_NAME	128
VID_PACKAGE_NAME	129
VID_SERVICE_TYPE	130
VID_IP_PROTO	131
VID_IP_PORT	132
VID_SERVICE_REQUEST	133
VID_SERVICE_RESPONSE	134
VID_POLLER_NODE_ID	135
VID_SERVICE_STATUS	136
VID_NUM_PARAMETERS	137

VID_NUM_OBJECTS	138
VID_OBJECT_LIST	139
VID_DEPLOYMENT_STATUS	140
VID_ERROR_MESSAGE	141
VID_SERVER_ID	142
VID_SEARCH_PATTERN	143
VID_NUM_VARIABLES	144
VID_COMMAND	145
VID_PROTOCOL_VERSION	146
VID_ZONE_GUID	147
VID_ZONE_TYPE	148
VID_CONTROLLER_IP_ADDR	149
VID_ADDR_LIST_SIZE	150
VID_IP_ADDR_LIST	151
VID_REMOVE_DCI	152
VID_TEMPLATE_ID	153
VID_PUBLIC_KEY	154
VID_SESSION_KEY	155
VID_CIPHER	156
VID_KEY_LENGTH	157
VID_SESSION_IV	158
VID_CONFIG_FILE	159
VID_STATUS_CALCULATION_ALG	160
VID_NUM_LOCAL_NETS	161
VID_NUM_REMOTE_NETS	162
VID_APPLY_FLAG	163
VID_NUM_TOOLS	164
VID_TOOL_ID	165

VID_NUM_COLUMNS	166
VID_NUM_ROWS	167
VID_TABLE_TITLE	168
VID_LPP_ID	169
VID_LPP_VERSION	170
VID_LOG_NAME	171
VID_OPERATION	172
VID_MAX_RECORDS	173
VID_NUM_RECORDS	174
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VID_OS_INFO	176
VID_LIBNXCL_VERSION	177
VID_VERSION	178
VID_NUM_NODES	179
VID_LOG_FILE	180
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VID_STATUS_TRANSLATION_2	187
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VID_STATUS_SINGLE_THRESHOLD	190
VID_STATUS_THRESHOLD_1	191
VID_STATUS_THRESHOLD_2	192
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VID_TOOL_DATA	197
VID_ACL	198
VID_TOOL_OID	199
VID_SERVER_UPTIME	200
VID_NUM_ALARMS	201
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VID_NETXMSD_PROCESS_WKSET	203
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VID_MAP_ID	216
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