BORSAT OS System Calls

Version: 3

Created: Dec 25, 2024

Copywrite: 2021-2025, Zero Point Design and Development Inc.

# Table of Contents

[Table of Contents 2](#_Toc64735404)

[Background 3](#_Toc64735405)

[**System Functions** 3](#_Toc64735406)

[**File System Functions** 9](#_Toc64735407)

[**Network Functions** 11](#_Toc64735408)

[**GUI Functions** 15](#_Toc64735409)

[**Draw Functions** 16](#_Toc64735410)

[**Process Functions** 17](#_Toc64735411)

## Intended Audience

It is assumed the person reading this knows Intel Assembly.

## Background

BORSAT OS uses one system call (i.e. interrupt call) for all user functions; 0xFF (e.g. int 0xff). The sections below gives a brief description of the intent of the system function and required parameters. Each system function is identified using register RDX.

The system functions described below use the following format:

#### Description of function

Parameters: *<registers used to call the function. Note, RDX is always required>*

Returns: *<return values and which registers the values are returned to>*

INT 0xFF

Parameters: RDX = function number

RAX – R15 = parameters for specific function

## **System Functions**

#### Stop the running program

Parameters: RDX = 0x0

Returns: n/a

#### Return interrupt ticker count

Parameters: RDX = 0x1

Returns: RAX = current ticker count

*Become active STDIN process for the keyboard*

Used for taking keyboard control

Parameters: RDX = 0x3

Returns: n/a

*Get active STDIN process for the keyboard*

Used to determine which program has control of the keyboard.

Parameters: RDX = 0x4

Returns: n/a

*Release STDIN for the keyboard*

Used for giving back control of the keyboard to the OS.

Parameters: RDX = 0x5

Returns: n/a

*Hide Cursor*

Parameters: RDX = 0x6

Returns: n/a

*Show Cursor*

Parameters: RDX = 0x7

Returns: n/a

*Reset cursor to start position*

Parameters: RDX = 0x8

Returns: n/a

#### Returns the process ID (PID) of the running program

Parameters: RDX = 0x9

Returns: EAX = PID

*Network transmit*

System call for transmitting a frame. Low level function, use at your own risk. Tells the OS to send whatever is in the transmit system memory buffer.

Parameters: RDX = 0xA

RSI = NIC memory location

RAX = memory location of frame

RCX = size of frame

Returns: <nothing>

*Network receive*

System call for receiving a frame. Low level function, use at your own risk. Tells the OS to poll the Receive Descriptor and Receive system memory buffer to network frames.

Parameters: RDX = 0xB

RSI = NIC memory location

RDI = Receive descriptor memory location

RAX = memory location of frame

Returns: RCX = size of frame

*Current time in millisecond and fractions of a millisecond*

Use this system call for precise time keeping.

Parameters: RDX = 0xC

Returns: RAX = milliseconds

RBX = fractions of a millisecond

*Current time in milliseconds only*

Parameters: RDX = 0xD

Returns: RAX = milliseconds

*Clear screen*

Clears the screen.

Parameters: RDX = 0xE

Returns: <nothing>

*Switch to another process*

Use this to save CPU time. Rather than waiting for another process to do something, force a process switch from the current process so that the other processes run.

Parameters: RDX = 0xF

Returns: <nothing>

*Deallocates memory from a process*

This will give memory back to the system, to be reused again.

Parameters: RDX = 0x10

RAX = process’ virtual memory location

RCX = size (in bytes) to deallocate

Returns: <nothing>

#### Generate a random number

Parameters: RDX = 0x11

CL = size of random number to generate

1 = generate a number between 0 - 15

2 = generate a number between 0 - 255

3 = generate a number between 0 - 65535

4 = generate a number between 0 - 16,772,215

5 = generate a number between 0 - 4,294,967,295

6 = generate a number between 0 - 18,446,744,073,709,551,615

Returns: RCX = random number

#### Return current time in seconds

Parameters: RDX = 0x1D

Returns: RAX = current time in seconds

#### Prints to X/Y coordinates

Text mode or GUI mode print to X,Y location. X will use character width \* X. And Y will use character height \* Y.

NOTE: This routine will not clear the screen.

Parameters: RDX = 0x400

AL = X

AH = Y

RSI = pointer to string location

Returns: <nothing>

#### Prints to X/Y coordinates, at a specified width and specified number of characters.

Parameters: RDX = 0x401

AL = X

AH = Y

BX = width

CX = number of characters to print

RSI = pointer to string location

Returns: <nothing>

#### Return Process ID number for a given program name string

Parameters: RDX = 0x403

Parameters: RSI = pointer to program name string location (virtual address)

Returns: EBX = process ID number (PID). 0xFFFFF (5 f’s) is a not found error.

#### Send an IPC message to a specified process

Parameters: RDX = 0x404

RSI = pointer to message to send

CX = size of message to send (min 32)

BX = PID to send message to

Returns: BX = Return code;

0 = success

1 = PID not found

2 = Destination PID’s header does not have enough space

#### Share memory with another process

Parameters: RDX = 0x405

RSI = pointer to memory to share

CX = size of memory to share (in 4K blocks)

BX = PID to share memory with

Returns: BX = Return code;

0 = success

1 = PID not found

#### Read currently running IPC message header

Reads the IPC message header for a currently running process. Then returns the first 32 bytes. This system call would be used if you need to read a message while the running process is in an interrupt and cannot easily read the IPC memory.

Parameters: RDX = 0x406

Returns: RAX = Returns message (bytes 0 – 7)

RBX = Returns message (bytes 8 – 15)

RCX = Returns message (bytes 16 – 23)

RDX = Returns message (bytes 24 - 32)

#### Read currently running IPC message header – brief

Reads the IPC message header for a currently running process. However, only returns the first 8 bytes. This system call would be used if you need to read a message while the running process is in an interrupt and cannot easily read the IPC memory.

Parameters: RDX = 0x407

Returns: RAX = Returns message (bytes 0 – 7)

#### Read currently running IPC message header and return data

Reads the IPC message header for a currently running process. Then skips the CMD field and returns the first 32 bytes of data. This system call would be used if you need to read a message while the running process is in an interrupt and cannot easily read the IPC memory.

Parameters: RDX = 0x408

Returns: RAX = Returns message (bytes 0 – 7) of data

RBX = Returns message (bytes 8 – 15) of data

RCX = Returns message (bytes 16 – 23) of data

RDX = Returns message (bytes 24 - 32) of data

#### Clears the IPC header for the currently running process

Parameters: RDX = 0x409

Returns: <nothing>

#### Check for queued IPC message

Checks if the currently running process has an IPC message queued. If so, populates the process’ IPC header with the message.

Parameters: RDX = 0x40A

Returns: BX = Return code;

0 = no messages found

1 = queued message found

#### Check for pending sent IPC message(s)

Checks if the currently running process has IPC message(s) queued to a specified process. If so, returns the number of messages queued.

Parameters: RDX = 0x40B

Returns: BX = Return code;

0 = no messages found

1 = number of messages found

#### Print

Prints a string to the screen. This will do a raw print and will not do any type of word wrapping.

NOTE: This routine will not clear the screen.

Parameters: RDX = 0x40E

RSI = pointer to string location

Returns: <nothing>

#### Release or deallocate shared memory

Releases or deallocates shared memory from a currently running process. Depending on conditions, memory is released, or, deallocated and given back to the OS.

Parameters: RDX = 0x422

RAX = virtual memory that is shared

CX = size of memory shared

Returns: BX = Return code;

0 = success

1 = error

#### Release and deallocate shared memory

Releases and deallocates shared memory from a currently running process. NOTE: This call will not check if there is another program using the memory. This routine is meant for use cases that memory should be given back to the OS (e.g. TCP connection closes, give the OS back the receive buffer).

Parameters: RDX = 0x423

RAX = virtual memory that is shared

CX = size of memory shared

Returns: BX = Return code;

0 = success

1 = error

#### Sound Blaster 16 – Memory Allocation

Gets a request from a user program to allocate memory for the SB16 card. Because memory for SB16 DMA has specific things, I have created an IRQ system call and routine to do it.

Parameters: RDX = 0x424

RCX = Size (bytes) to allocate. If zero use maximum (65535), if more then maximum, use maximum.

Returns: RAX = Memory address. Zero if none available.

RCX = Size (bytes) of memory allocated

#### Register Interrupt Handler

Connects a function to an interrupt. Also known as an Interrupt Service Routine (ISR) handler.

NOTE: Use with extreme caution!!

Parameters: RDX = 0x425

AL = IRQ number

AH = ISR flags, 0 for default values

RBX = memory location of ISR routine that will run when IRQ fires

Returns: N/A

## **File System Functions**

#### Start a file in storage (HDD)

Start a new file. This WILL overwrite an existing file.

Parameters: RDX = 0x500

RSI = Memory pointer to filename string.

Returns: RAX = cluster number (if FAT32)

BL = return code

0: success

-1: Error, finding file

-2: Error, ran out of memory

-3: Error, creating directory

-4: Error, no space for new file

-5: Error with storage

-6: Error deleting file

#### Append a file in storage (HDD)

Append data to an existing file.

Parameters: RDX = 0x501

RAX = memory pointer to location of data

RCX = number of bytes to append

RSI = Memory pointer to filename string.

Returns: n/a

#### File Exists

Check if a file or directory already exists.

NOTE: Use DL to determine if a file is found or not. There is a case that a cluster number can be zero (when the parent directory is a root directory, 0 will be returned).

Parameters: RDX = 0x504

RSI = Pointer to NULL terminated filename.

Returns: RAX = cluster number.

DL = 0 nothing found

1 found a file

2 found a directory

90 ERROR - no memory available

#### Check for, and return a queued message

Checks the Send Message queue to see if the currently running process has a message to be sent to it. If so, then the message will be copied to the currently running process’ IPC header.

Parameters: RDX = 0x40A

Returns: BL = Return code;

0 = no messages waiting

1 = found a message (IPC header populated).

#### Check for pending sent messages

Checks if the currently running process has any messages still waiting to be sent to another process.

Parameters: RDX = 0x40B

BX = Process ID (PID) sending the message(s) to.

Returns: BL = Return code;

0 = no messages waiting

1 = message(s) waiting in the queue

## **Network Functions**

#### DHCP request

Run a DHCP request for a specified NIC.

Parameters: RDX = 0x12

RSI = NIC memory address

Returns: n/a

#### DHCP release

Release DHCP address for a specified NIC.

Parameters: RDX = 0x13

RSI = NIC memory address

Returns: n/a

#### DHCP renew

Renews a DHCP address for a specified NIC.

Parameters: RDX = 0x14

RSI = NIC memory address

Returns: n/a

#### Get network return code

Get a response code from the Network Module.

Parameters: RDX = 0x16

RCX = network transaction ID

Returns: RAX = return code

0 = transaction ID matches (good time to get the values in function 0x17).

-1 = no match (should keep waiting or time out).

#### Get network values

Get values from the Network Module.

Parameters: RDX = 0x17

RCX = network transaction ID

Returns: R8 = Response field 1 (8 bytes)

R9 = Response field 2 (8 bytes)

R10 = Response field 3 (up to 1512 bytes)

#### Get IP addresses for all NICs

Returns the IP addresses and network masks for all of the NICs. If a NIC does not have an IP, then it will return zero. The high DWORD is the mask, the low DWORD is the IP address.

Parameters: RDX = 0x1A

Returns: RAX = NIC1 mask / IP address

RBX = NIC2 mask / IP address

RCX = NIC3 mask / IP address

RDX = NIC4 mask / IP address

#### Get IP addresses for a specific NIC

Returns the IP address and network mask for one of the NICs. If the NIC does not have an IP, then it will return zero. The high DWORD is the mask, the low DWORD is the IP address.

Parameters: RDX = 0x1B

CL = NIC number <1 to 4>, returns zero if invalid entry

Returns: EAX = mask / IP address

#### Send a raw packet

Parameters: RDX = 0x20

RSI = NIC memory location

RDI = memory location of packet

Packet information / payload structure is as follows:

DWORD - Dst IP

DWORD - Src Port / Dst Port

DWORD - Protocol number (TCP, UDP, etc) / payload size (bytes)

BYTES - payload

Returns: <nothing>

*Request to open a TCP connection*

Parameters: RDX = 0x25

RAX = Destination port (2 bytes, high DWORD) / destination IP address (4 bytes,

low DWORD).

ECX = Size of receive buffer. Maximum size is 1,073,725,440 (0x3FFFC000) bytes.

Should be an even number. Otherwise will be rounded down to the next

even number (eg. 65535 will become 65534).

RDI = Receive buffer location.

Returns: RAX = return code; 0=success, -1 error starting request, refer to Return Codes for more information.

RCX = connection ID

#### Close a TCP connection

Parameters: RDX = 0x27

RCX = connection ID

Returns: RAX = return code; 0x3FF=close completed,

-1 could not send close to network module

#### Send data over an existing TCP connection

Parameters: RDX = 0x28

EAX = Send buffer size.

RCX = connection ID

RSI = virtual address of send buffer

Returns: RAX = return code; network response code,

-1 could not send close to network module

#### Signal OS that the receive buffer can be cleared and used again.

Parameters: RDX = 0x29

RCX = connection ID

Returns: RAX = return code; 0 = completed,

-1 could not send to network module

#### Send data over an existing TCP connection using the send queue

Parameters: RDX = 0x2B

EAX = Send buffer size.

RCX = connection ID

RSI = virtual address of send buffer

Returns: RAX = return code; network response code,

-1 could not send close to network module

#### Opens a TCP listener port.

Parameters: RDX = 0x30

AX = Port

ECX = size of receive buffer

RDI = receive buffer location

Returns: RAX = return code; 0=success, refer to NET\_RTN\_ codes

RCX = connection ID

#### DNS Query.

Parameters: RDX = 0x40

AX = Type number, valid numbers are:

A equ 1 ; IPv4 address

NS equ 2 ; name server lookup

CNAME equ 5 ; alias name

PTR equ 12 ; reverse record lookup

MX equ 15 ; mail exchange

AAAA equ 28 ; IPv6 address

RSI = address pointer to query string

Returns: RAX = return code; 0=success, refer to NET\_RTN\_ codes

RSI = using the same address space as the query string, returns the results

#### List DNS Servers configured for a NIC.

Parameters: RDX = 0x41

CL = NIC number; valid values are 1 to 4

Returns: RAX = DNS server 1; 32bit IP address, zero if not configured

RBX = DNS server 2; 32bit IP address, zero if not configured

RCX = DNS server 3; 32bit IP address, zero if not configured

## **GUI Functions**

#### Get linear address

Parameters: RDX = 0x100

AX = X

BX = Y

Returns: RDI = linear address

#### Get character size

Parameters: RDX = 0x101

R10 = character code (aka ASCII value)

Returns: AX = width in pixels

BX = height in pixels

If character code not found, then AX & BX will be zero

#### Get Y pitch

Parameters: RDX = 0x102

Returns: AX = pitch value

#### Get number of bytes per pixel

Parameters: RDX = 0x103

Returns: AX = bytes per pixel

#### Get the X resolution of the screen

Parameters: RDX = 0x104

Returns: AX = number of pixels

#### Get the Y resolution of the screen

Parameters: RDX = 0x105

Returns: AX = number of pixels

#### Get number of bits per pixel

Parameters: RDX = 0x106

Returns: AX = bits

#### Get GUI ON

Parameters: RDX = 0x10D

Returns: AL = mode; 0=text mode, 1=graphics mode

#### Clears GUI input box

Parameters: RDX = 0x10E

Returns: <nothing>

## **Draw Functions**

#### Draw a character

Parameters: RDX = 0x120

AX = X coordinate

BX = Y coordinate

ECX = color

R10 = character code

Returns: <nothing>

#### Draws a NULL terminated string

Parameters: RDX = 0x121

AX = X coordinate

BX = Y coordinate

ECX = color

RSI = memory location of NULL terminated string

Returns: <nothing>

#### Draws a full box

Parameters: RDX = 0x126

R8 = starting X (left)

R9 = starting Y (top)

R10 = width

R11 = height

ECX = color

Returns: <nothing>

*'Types' (i.e. cat) a large amount of data to the MAINSCR*

Parameters: RDX = 0x129

RCX = number of bytes to display

RSI = memory location of data

Returns: <nothing>

## **Process Functions**

#### Get Process ID

Get the process ID of the currently running program. Used to find out the calling program’s ID.

Parameters: RDX = 0x200

Returns: AX = process ID

#### Run program from a user program

Wrapper routine to run a process from a user mode process. This allows the OS to put in checks and security so that a user process does not go out of control.

Parameters: RDX = 0x220

RAX = virtual address of memory pointer to program name

BL = number of parameters to pass; maximum 3

R8 = parameter 1

R9 = parameter 2

R10 = parameter 3

R14 = process' page directory address

Returns: AL = return status; 0=success, otherwise error code

0=success

1=file not found

2=no memory available

5=invalid parameter stack pointer

RBX = memory location of process

RCX = size of process, in bytes

DX = process number Parameters:

#### Allocate memory for a user program

Parameters: RDX = 0x221

RAX = number of bytes to allocate

Returns: RAX = virtual address where memory begins, 0 if error

BL = return code; 0=success, 1=not enough memory

#### Deallocate memory from a user program and gives it back to the OS to be used again.

Parameters: RDX = 0x222

RAX = start of virtual memory location

RCX = number of bytes to deallocate

Returns: n/a

#### Releases memory from a user program.

Releases memory from a user program but does not release memory back to the OS. Typical use case for this is when memory is shared among 2 or more user programs. One user program must own the responsibility of giving the memory back to the OS.

Parameters: RDX = 0x223

RAX = start of virtual memory location

RCX = number of bytes to release

Returns: n/a