x86matthew Twitter: @x86matthew E-Mail: x86matthew@gmail.com

CreateSvcRpc - A custom RPC client to execute programs as the SYSTEM user

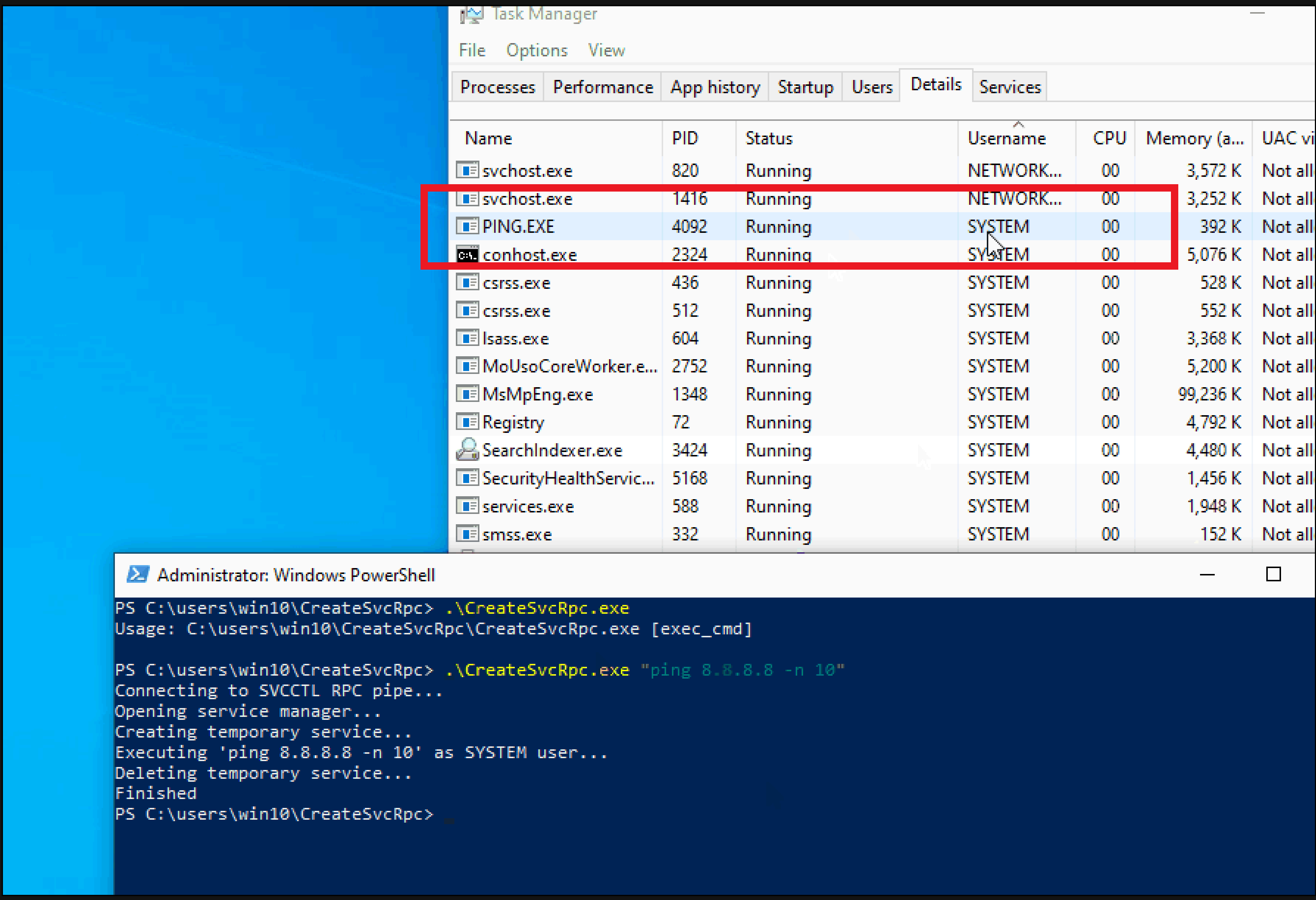
04/02/2022

The Windows RPC protocol is an area that I haven't previously experimented with very much. I have now created a custom RPC client which communicates with the ntsvcs pipe using raw data. This means it is possible to create and execute a Windows service using only the `CreateFile` and `WriteFile` APIs.

The RPC protocol seems to be somewhat documented, but the relevant information is so fragmented that I found it easier to reverse-engineer it from scratch.

I logged the communication of the Windows service APIs by hooking the `NtWriteFile`, `NtReadFile`, and `NtFsControlFile` functions. I analysed this data flow to gradually build my own RPC client.

After I got my first version working, I found some useful information in the Wireshark documentation which helped me label the remaining unknown fields in the RPC headers.


Task Manager
File Options View
Processes Performance App history Startup Users Details Services

Name	PID	Status	Username	CPU	Memory (a...	UAC vi
svchost.exe	820	Running	NETWORK...	00	3,572 K	Not all
svchost.exe	1416	Running	NETWORK...	00	3,252 K	Not all
PING.EXE	4092	Running	SYSTEM	00	392 K	Not all
conhost.exe	2324	Running	SYSTEM	00	5,076 K	Not all
csrss.exe	436	Running	SYSTEM	00	528 K	Not all
csrss.exe	512	Running	SYSTEM	00	552 K	Not all
lsass.exe	604	Running	SYSTEM	00	3,368 K	Not all
MoUsoCoreWorker.e...	2752	Running	SYSTEM	00	5,200 K	Not all
MsMpEng.exe	1348	Running	SYSTEM	00	99,236 K	Not all
Registry	72	Running	SYSTEM	00	4,792 K	Not all
SearchIndexer.exe	3424	Running	SYSTEM	00	4,480 K	Not all
SecurityHealthServic...	5168	Running	SYSTEM	00	1,456 K	Not all
services.exe	588	Running	SYSTEM	00	1,948 K	Not all
smss.exe	332	Running	SYSTEM	00	152 K	Not all

Administrator: Windows PowerShell

```
PS C:\users\win10\CreateSvcRpc> .\CreateSvcRpc.exe
Usage: C:\users\win10\CreateSvcRpc\CreateSvcRpc.exe [exec_cmd]

PS C:\users\win10\CreateSvcRpc> .\CreateSvcRpc.exe "ping 8.8.8.8 -n 10"
Connecting to SVCCTL RPC pipe...
Opening service manager...
Creating temporary service...
Executing 'ping 8.8.8.8 -n 10' as SYSTEM user...
Deleting temporary service...
Finished
PS C:\users\win10\CreateSvcRpc>
```

Full program code below:

```
#include <stdio.h>
#include <windows.h>

// rpc command ids
#define RPC_CMD_ID_OPEN_SC_MANAGER 27
#define RPC_CMD_ID_CREATE_SERVICE 24
#define RPC_CMD_ID_START_SERVICE 31
#define RPC_CMD_ID_DELETE_SERVICE 2

// rpc command output lengths
#define RPC_OUTPUT_LENGTH_OPEN_SC_MANAGER 24
#define RPC_OUTPUT_LENGTH_CREATE_SERVICE 28
#define RPC_OUTPUT_LENGTH_START_SERVICE 4
#define RPC_OUTPUT_LENGTH_DELETE_SERVICE 4

#define MAX_RPC_PACKET_LENGTH 4096
#define MAX_PROCEDURE_DATA_LENGTH 2048
```

```
#define CALC_ALIGN_PADDING(VALUE_LENGTH, ALIGN_BYTES) ((((VALUE_LENGTH + ALIGN_BYTES - 1) / ALIGN_BYTES)

struct RpcBaseHeaderStruct
{
        WORD wVersion;
        BYTE bPacketType;
        BYTE bPacketFlags;
        DWORD dwDataRepresentation;
        WORD wFragLength;
        WORD wAuthLength;
        DWORD dwCallIndex;
};

struct RpcRequestHeaderStruct
{
        DWORD dwAllocHint;
        WORD wContextID;
        WORD wProcedureNumber;
};

struct RpcResponseHeaderStruct
{
        DWORD dwAllocHint;
        WORD wContextID;
        BYTE bCancelCount;
        BYTE bAlign[1];
};

struct RpcBindRequestContextEntryStruct
{
        WORD wContextID;
        WORD wTransItemCount;
        BYTE bInterfaceUUID[16];
        DWORD dwInterfaceVersion;
        BYTE bTransferSyntaxUUID[16];
        DWORD dwTransferSyntaxVersion;
};

struct RpcBindRequestHeaderStruct
{
        WORD wMaxSendFrag;
        WORD wMaxRecvFrag;
        DWORD dwAssocGroup;
        BYTE bContextCount;
        BYTE bAlign[3];

        RpcBindRequestContextEntryStruct Context;
};

struct RpcBindResponseContextEntryStruct
{
        WORD wResult;
        WORD wAlign;
        BYTE bTransferSyntax[16];
        DWORD dwTransferSyntaxVersion;
};

struct RpcBindResponseHeader1Struct
{
        WORD wMaxSendFrag;
        WORD wMaxRecvFrag;
        DWORD dwAssocGroup;
};

struct RpcBindResponseHeader2Struct
{
        DWORD dwContextResultCount;
        RpcBindResponseContextEntryStruct Context;
};

struct RpcConnectionStruct
{
        HANDLE hFile;
        DWORD dwCallIndex;

        DWORD dwInputError;

        DWORD dwRequestInitialised;

        BYTE bProcedureInputData[MAX_PROCEDURE_DATA_LENGTH];
        DWORD dwProcedureInputDataLength;

        BYTE bProcedureOutputData[MAX_PROCEDURE_DATA_LENGTH];
        DWORD dwProcedureOutputDataLength;
};

DWORD RpcConvertUUID(char *pString, BYTE *pUUID, DWORD dwMaxLength)
{
        BYTE bUUID[16];
        BYTE bFixedUUID[16];
        DWORD dwUUIDLength = 0;
        BYTE bCurrInputChar = 0;
        BYTE bConvertedByte = 0;
        DWORD dwProcessedByteCount = 0;
        BYTE bCurrOutputByte = 0;

        // ensure output buffer is large enough
        if(dwMaxLength < 16)
        {
                return 1;
        }

        // check uuid length
        dwUUIDLength = strlen("00000000-0000-0000-0000-000000000000");
        if(strlen(pString) != dwUUIDLength)
```

```
	{
		return 1;
	}

	// convert string to uuid
	for(DWORD i = 0; i < dwUUIDLength; i++)
	{
		// get current input character
		bCurrInputChar = *(BYTE*)((BYTE*)pString + i);

		// check if a dash character is expected here
		if(i == 8 || i == 13 || i == 18 || i == 23)
		{
			if(bCurrInputChar == '-')
			{
				continue;
			}
			else
			{
				return 1;
			}
		}
		else
		{
			// check current input character value
			if(bCurrInputChar >= 'a' && bCurrInputChar <= 'f')
			{
				bConvertedByte = 0xA + (bCurrInputChar - 'a');
			}
			else if(bCurrInputChar >= 'A' && bCurrInputChar <= 'F')
			{
				bConvertedByte = 0xA + (bCurrInputChar - 'A');
			}
			else if(bCurrInputChar >= '0' && bCurrInputChar <= '9')
			{
				bConvertedByte = 0 + (bCurrInputChar - '0');
			}
			else
			{
				// invalid character
				return 1;
			}

			if((dwProcessedByteCount % 2) == 0)
			{
				bCurrOutputByte = bConvertedByte * 0x10;
			}
			else
			{
				bCurrOutputByte += bConvertedByte;

				// store current uuid byte
				bUUID[(dwProcessedByteCount - 1) / 2] = bCurrOutputByte;
			}
			dwProcessedByteCount++;
		}
	}

	// fix uuid endianness
	memcpy((void*)bFixedUUID, (void*)bUUID, sizeof(bUUID));
	bFixedUUID[0] = bUUID[3];
	bFixedUUID[1] = bUUID[2];
	bFixedUUID[2] = bUUID[1];
	bFixedUUID[3] = bUUID[0];
	bFixedUUID[4] = bUUID[5];
	bFixedUUID[5] = bUUID[4];
	bFixedUUID[6] = bUUID[7];
	bFixedUUID[7] = bUUID[6];

	// store uuid
	memcpy((void*)pUUID, (void*)bFixedUUID, sizeof(bUUID));

	return 0;
}

DWORD RpcBind(RpcConnectionStruct *pRpcConnection, char *pInterfaceUUID, DWORD dwInterfaceVersion)
{
	RpcBaseHeaderStruct RpcBaseHeader;
	RpcBindRequestHeaderStruct RpcBindRequestHeader;
	DWORD dwBytesWritten = 0;
	DWORD dwBytesRead = 0;
	BYTE bResponseData[MAX_RPC_PACKET_LENGTH];
	RpcBaseHeaderStruct *pRpcResponseBaseHeader = NULL;
	RpcBindResponseHeader1Struct *pRpcBindResponseHeader1 = NULL;
	RpcBindResponseHeader2Struct *pRpcBindResponseHeader2 = NULL;
	BYTE *pSecondaryAddrHeaderBlock = NULL;
	WORD wSecondaryAddrLen = 0;
	DWORD dwSecondaryAddrAlign = 0;

	// set base header details
	memset((void*)&RpcBaseHeader, 0, sizeof(RpcBaseHeader));
	RpcBaseHeader.wVersion = 5;
	RpcBaseHeader.bPacketType = 11;
	RpcBaseHeader.bPacketFlags = 3;
	RpcBaseHeader.dwDataRepresentation = 0x10;
	RpcBaseHeader.wFragLength = sizeof(RpcBaseHeader) + sizeof(RpcBindRequestHeader);
	RpcBaseHeader.wAuthLength = 0;
	RpcBaseHeader.dwCallIndex = pRpcConnection->dwCallIndex;

	// set bind request header details
	memset((void*)&RpcBindRequestHeader, 0, sizeof(RpcBindRequestHeader));
	RpcBindRequestHeader.wMaxSendFrag = MAX_RPC_PACKET_LENGTH;
	RpcBindRequestHeader.wMaxRecvFrag = MAX_RPC_PACKET_LENGTH;
	RpcBindRequestHeader.dwAssocGroup = 0;
	RpcBindRequestHeader.bContextCount = 1;
	RpcBindRequestHeader.Context.wContextID = 0;
	RpcBindRequestHeader.Context.wTransItemCount = 1;
	RpcBindRequestHeader.Context.dwTransferSyntaxVersion = 2;

	// get interface UUID
	if(RpcConvertUUID(pInterfaceUUID, RpcBindRequestHeader.Context.bInterfaceUUID, sizeof(RpcBindRe
	{
		return 1;
	}
	RpcBindRequestHeader.Context.dwInterfaceVersion = dwInterfaceVersion;

	// {8a885d04-1ceb-11c9-9fe8-08002b104860} (NDR)
	if(RpcConvertUUID("8a885d04-1ceb-11c9-9fe8-08002b104860", RpcBindRequestHeader.Context.bTransfe
	{
		return 1;
	}

	// write base header
	if(WriteFile(pRpcConnection->hFile, (void*)&RpcBaseHeader, sizeof(RpcBaseHeader), &dwBytesWritt
	{
		return 1;
	}

	// write bind request header
	if(WriteFile(pRpcConnection->hFile, (void*)&RpcBindRequestHeader, sizeof(RpcBindRequestHeader),
	{
		return 1;
	}

	// increase call index
	pRpcConnection->dwCallIndex++;

	// get bind response
	memset((void*)&bResponseData, 0, sizeof(bResponseData));
	if(ReadFile(pRpcConnection->hFile, (void*)bResponseData, sizeof(bResponseData), &dwBytesRead, NU
	{
		return 1;
	}

	// get a ptr to the base response header
	pRpcResponseBaseHeader = (RpcBaseHeaderStruct*)bResponseData;

	// validate base response header
	if(pRpcResponseBaseHeader->wVersion != 5)
	{
		return 1;
	}
	if(pRpcResponseBaseHeader->bPacketType != 12)
	{
		return 1;
	}
	if(pRpcResponseBaseHeader->bPacketFlags != 3)
	{
		return 1;
	}
	if(pRpcResponseBaseHeader->wFragLength != dwBytesRead)
	{
		return 1;
	}

	// get a ptr to the main bind response header body
	pRpcBindResponseHeader1 = (RpcBindResponseHeader1Struct*)((BYTE*)pRpcResponseBaseHeader + sizeo

	// get secondary addr header ptr
	pSecondaryAddrHeaderBlock = (BYTE*)pRpcBindResponseHeader1 + sizeof(RpcBindResponseHeader1Struc
	wSecondaryAddrLen = *(WORD*)pSecondaryAddrHeaderBlock;

	// validate secondary addr length
	if(wSecondaryAddrLen > 256)
	{
		return 1;
	}

	// calculate padding for secondary addr value if necessary
	dwSecondaryAddrAlign = CALC_ALIGN_PADDING((sizeof(WORD) + wSecondaryAddrLen), 4);

	// get a ptr to the main bind response header body (after the variable-length secondary addr fi
	pRpcBindResponseHeader2 = (RpcBindResponseHeader2Struct*)((BYTE*)pSecondaryAddrHeaderBlock + si

	// validate context count
	if(pRpcBindResponseHeader2->dwContextResultCount != 1)
	{
		return 1;
	}

	// ensure the result value for context #1 was successful
	if(pRpcBindResponseHeader2->Context.wResult != 0)
	{
		return 1;
	}

	return 0;
}

DWORD RpcConnect(char *pPipeName, char *pInterfaceUUID, DWORD dwInterfaceVersion, RpcConnectionStruct *
{
	HANDLE hFile = NULL;
	char szPipePath[512];
	RpcConnectionStruct RpcConnection;

	// set pipe path
	memset(szPipePath, 0, sizeof(szPipePath));
	_snprintf(szPipePath, sizeof(szPipePath) - 1, "\\\\.\\pipe\\%s", pPipeName);

	// open rpc pipe
	hFile = CreateFile(szPipePath, GENERIC_READ | GENERIC_WRITE, 0, NULL, OPEN_EXISTING, 0, NULL);
	if(hFile == INVALID_HANDLE_VALUE)
```

```
        {
                return 1;
        }

        // initialise rpc connection data
        memset((void*)&RpcConnection, 0, sizeof(RpcConnection));
        RpcConnection.hFile = hFile;
        RpcConnection.dwCallIndex = 1;

        // bind rpc connection
        if(RpcBind(&RpcConnection, pInterfaceUUID, dwInterfaceVersion) != 0)
        {
                return 1;
        }

        // store connection data
        memcpy((void*)pRpcConnection, (void*)&RpcConnection, sizeof(RpcConnection));

        return 0;
}

DWORD RpcSendRequest(RpcConnectionStruct *pRpcConnection, DWORD dwProcedureNumber)
{
        RpcBaseHeaderStruct RpcBaseHeader;
        RpcRequestHeaderStruct RpcRequestHeader;
        DWORD dwBytesWritten = 0;
        BYTE bResponseData[MAX_RPC_PACKET_LENGTH];
        RpcBaseHeaderStruct *pRpcResponseBaseHeader = NULL;
        RpcResponseHeaderStruct *pRpcResponseHeader = NULL;
        DWORD dwProcedureResponseDataLength = 0;
        DWORD dwBytesRead = 0;
        BYTE *pTempProcedureResponseDataPtr = NULL;

        // ensure rpc request has been initialised
        if(pRpcConnection->dwRequestInitialised == 0)
        {
                return 1;
        }

        // clear initialised flag
        pRpcConnection->dwRequestInitialised = 0;

        // check for input errors
        if(pRpcConnection->dwInputError != 0)
        {
                return 1;
        }

        // set base header details
        memset((void*)&RpcBaseHeader, 0, sizeof(RpcBaseHeader));
        RpcBaseHeader.wVersion = 5;
        RpcBaseHeader.bPacketType = 0;
        RpcBaseHeader.bPacketFlags = 3;
        RpcBaseHeader.dwDataRepresentation = 0x10;
        RpcBaseHeader.wFragLength = sizeof(RpcBaseHeader) + sizeof(RpcRequestHeader) + pRpcConnection->
        RpcBaseHeader.wAuthLength = 0;
        RpcBaseHeader.dwCallIndex = pRpcConnection->dwCallIndex;

        // set request header details
        memset((void*)&RpcRequestHeader, 0, sizeof(RpcRequestHeader));
        RpcRequestHeader.dwAllocHint = 0;
        RpcRequestHeader.wContextID = 0;
        RpcRequestHeader.wProcedureNumber = (WORD)dwProcedureNumber;

        // write base header
        if(WriteFile(pRpcConnection->hFile, (void*)&RpcBaseHeader, sizeof(RpcBaseHeader), &dwBytesWritt
        {
                return 1;
        }

        // write request header
        if(WriteFile(pRpcConnection->hFile, (void*)&RpcRequestHeader, sizeof(RpcRequestHeader), &dwByte
        {
                return 1;
        }

        // write request body
        if(WriteFile(pRpcConnection->hFile, (void*)pRpcConnection->bProcedureInputData, pRpcConnection->
        {
                return 1;
        }

        // increase call index
        pRpcConnection->dwCallIndex++;

        // get bind response
        memset((void*)&bResponseData, 0, sizeof(bResponseData));
        if(ReadFile(pRpcConnection->hFile, (void*)bResponseData, sizeof(bResponseData), &dwBytesRead, NU
        {
                return 1;
        }

        // get a ptr to the base response header
        pRpcResponseBaseHeader = (RpcBaseHeaderStruct*)bResponseData;

        // validate base response header
        if(pRpcResponseBaseHeader->wVersion != 5)
        {
                return 1;
        }
        if(pRpcResponseBaseHeader->bPacketType != 2)
        {
                return 1;
        }
        if(pRpcResponseBaseHeader->bPacketFlags != 3)
        {
```

```
		return 1;
	}
	if(pRpcResponseBaseHeader->wFragLength != dwBytesRead)
	{
		return 1;
	}

	// get a ptr to the main response header body
	pRpcResponseHeader = (RpcResponseHeaderStruct*)((BYTE*)pRpcResponseBaseHeader + sizeof(RpcBaseH

	// context ID must be 0
	if(pRpcResponseHeader->wContextID != 0)
	{
		return 1;
	}

	// calculate command response data length
	dwProcedureResponseDataLength = pRpcResponseBaseHeader->wFragLength - sizeof(RpcBaseHeaderStruc

	// store response data
	if(dwProcedureResponseDataLength > sizeof(pRpcConnection->bProcedureOutputData))
	{
		return 1;
	}
	pTempProcedureResponseDataPtr = (BYTE*)pRpcResponseHeader + sizeof(RpcResponseHeaderStruct);
	memcpy(pRpcConnection->bProcedureOutputData, pTempProcedureResponseDataPtr, dwProcedureResponse

	// store response data length
	pRpcConnection->dwProcedureOutputDataLength = dwProcedureResponseDataLength;

	return 0;
}

DWORD RpcInitialiseRequestData(RpcConnectionStruct *pRpcConnection)
{
	// initialise request data
	memset(pRpcConnection->bProcedureInputData, 0, sizeof(pRpcConnection->bProcedureInputData));
	pRpcConnection->dwProcedureInputDataLength = 0;
	memset(pRpcConnection->bProcedureOutputData, 0, sizeof(pRpcConnection->bProcedureOutputData));
	pRpcConnection->dwProcedureOutputDataLength = 0;

	// reset input error flag
	pRpcConnection->dwInputError = 0;

	// set initialised flag
	pRpcConnection->dwRequestInitialised = 1;

	return 0;
}

DWORD RpcAppendRequestData_Binary(RpcConnectionStruct *pRpcConnection, BYTE *pData, DWORD dwDataLength)
{
	DWORD dwBytesAvailable = 0;

	// ensure the request has been initialised
	if(pRpcConnection->dwRequestInitialised == 0)
	{
		return 1;
	}

	// calculate number of bytes remaining in the input buffer
	dwBytesAvailable = sizeof(pRpcConnection->bProcedureInputData) - pRpcConnection->dwProcedureInp
	if(dwDataLength > dwBytesAvailable)
	{
		// set input error flag
		pRpcConnection->dwInputError = 1;

		return 1;
	}

	// store data in buffer
	memcpy((void*)&pRpcConnection->bProcedureInputData[pRpcConnection->dwProcedureInputDataLength],
	pRpcConnection->dwProcedureInputDataLength += dwDataLength;

	// align to 4 bytes if necessary
	pRpcConnection->dwProcedureInputDataLength += CALC_ALIGN_PADDING(dwDataLength, 4);

	return 0;
}

DWORD RpcAppendRequestData_Dword(RpcConnectionStruct *pRpcConnection, DWORD dwValue)
{
	// add dword value
	if(RpcAppendRequestData_Binary(pRpcConnection, (BYTE*)&dwValue, sizeof(DWORD)) != 0)
	{
		return 1;
	}

	return 0;
}

DWORD RpcDisconnect(RpcConnectionStruct *pRpcConnection)
{
	// close pipe handle
	CloseHandle(pRpcConnection->hFile);

	return 0;
}

int main(int argc, char *argv[])
{
	RpcConnectionStruct RpcConnection;
	BYTE bServiceManagerObject[20];
	BYTE bServiceObject[20];
	DWORD dwReturnValue = 0;
	char szServiceName[256];
```

```
        DWORD dwServiceNameLength = 0;
        char szServiceCommandLine[256];
        DWORD dwServiceCommandLineLength = 0;
        char *pExecCmd = NULL;

        printf("CreateSvcRpc - www.x86matthew.com\n\n");

        if(argc != 2)
        {
                printf("Usage: %s [exec_cmd]\n\n", argv[0]);

                return 1;
        }

        // get cmd param
        pExecCmd = argv[1];

        // generate a temporary service name
        memset(szServiceName, 0, sizeof(szServiceName));
        _snprintf(szServiceName, sizeof(szServiceName) - 1, "CreateSvcRpc_%u", GetTickCount());
        dwServiceNameLength = strlen(szServiceName) + 1;

        // set service command line
        memset(szServiceCommandLine, 0, sizeof(szServiceCommandLine));
        _snprintf(szServiceCommandLine, sizeof(szServiceCommandLine) - 1, "cmd /c start %s", pExecCmd);
        dwServiceCommandLineLength = strlen(szServiceCommandLine) + 1;

        printf("Connecting to SVCCTL RPC pipe...\n");

        // open SVCCTL v2.0
        if(RpcConnect("ntsvcs", "367abb81-9844-35f1-ad32-98f038001003", 2, &RpcConnection) != 0)
        {
                printf("Failed to connect to RPC pipe\n");

                return 1;
        }

        printf("Opening service manager...\n");

        // OpenSCManager
        RpcInitialiseRequestData(&RpcConnection);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, SC_MANAGER_ALL_ACCESS);
        if(RpcSendRequest(&RpcConnection, RPC_CMD_ID_OPEN_SC_MANAGER) != 0)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // validate rpc output data length
        if(RpcConnection.dwProcedureOutputDataLength != RPC_OUTPUT_LENGTH_OPEN_SC_MANAGER)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // get return value
        dwReturnValue = *(DWORD*)&RpcConnection.bProcedureOutputData[20];

        // check return value
        if(dwReturnValue != 0)
        {
                printf("OpenSCManager error: %u\n", dwReturnValue);

                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // store service manager object
        memcpy(bServiceManagerObject, (void*)&RpcConnection.bProcedureOutputData[0], sizeof(bServiceMana

        printf("Creating temporary service...\n");

        // CreateService
        RpcInitialiseRequestData(&RpcConnection);
        RpcAppendRequestData_Binary(&RpcConnection, bServiceManagerObject, sizeof(bServiceManagerObject
        RpcAppendRequestData_Dword(&RpcConnection, dwServiceNameLength);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, dwServiceNameLength);
        RpcAppendRequestData_Binary(&RpcConnection, (BYTE*)szServiceName, dwServiceNameLength);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, SERVICE_ALL_ACCESS);
        RpcAppendRequestData_Dword(&RpcConnection, SERVICE_WIN32_OWN_PROCESS);
        RpcAppendRequestData_Dword(&RpcConnection, SERVICE_DEMAND_START);
        RpcAppendRequestData_Dword(&RpcConnection, SERVICE_ERROR_IGNORE);
        RpcAppendRequestData_Dword(&RpcConnection, dwServiceCommandLineLength);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, dwServiceCommandLineLength);
        RpcAppendRequestData_Binary(&RpcConnection, (BYTE*)szServiceCommandLine, dwServiceCommandLineLe
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        if(RpcSendRequest(&RpcConnection, RPC_CMD_ID_CREATE_SERVICE) != 0)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // validate rpc output data length
        if(RpcConnection.dwProcedureOutputDataLength != RPC_OUTPUT_LENGTH_CREATE_SERVICE)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // get return value
        dwReturnValue = *(DWORD*)&RpcConnection.bProcedureOutputData[24];

        // check return value
        if(dwReturnValue != 0)
        {
                printf("CreateService error: %u\n", dwReturnValue);

                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // store service object
        memcpy(bServiceObject, (void*)&RpcConnection.bProcedureOutputData[4], sizeof(bServiceObject));

        printf("Executing '%s' as SYSTEM user...\n", pExecCmd);

        // StartService
        RpcInitialiseRequestData(&RpcConnection);
        RpcAppendRequestData_Binary(&RpcConnection, bServiceObject, sizeof(bServiceObject));
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        RpcAppendRequestData_Dword(&RpcConnection, 0);
        if(RpcSendRequest(&RpcConnection, RPC_CMD_ID_START_SERVICE) != 0)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // validate rpc output data length
        if(RpcConnection.dwProcedureOutputDataLength != RPC_OUTPUT_LENGTH_START_SERVICE)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // get return value
        dwReturnValue = *(DWORD*)&RpcConnection.bProcedureOutputData[0];

        // check return value
        if(dwReturnValue != 0 && dwReturnValue != ERROR_SERVICE_REQUEST_TIMEOUT)
        {
                printf("StartService error: %u\n", dwReturnValue);

                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        printf("Deleting temporary service...\n");

        // DeleteService
        RpcInitialiseRequestData(&RpcConnection);
        RpcAppendRequestData_Binary(&RpcConnection, bServiceObject, sizeof(bServiceObject));
        if(RpcSendRequest(&RpcConnection, RPC_CMD_ID_DELETE_SERVICE) != 0)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // validate rpc output data length
        if(RpcConnection.dwProcedureOutputDataLength != RPC_OUTPUT_LENGTH_DELETE_SERVICE)
        {
                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        // get return value
        dwReturnValue = *(DWORD*)&RpcConnection.bProcedureOutputData[0];

        // check return value
        if(dwReturnValue != 0)
        {
                printf("DeleteService error: %u\n", dwReturnValue);

                // error
                RpcDisconnect(&RpcConnection);

                return 1;
        }

        printf("Finished\n");
```

```
	// disconnect from rpc pipe
	if(RpcDisconnect(&RpcConnection) != 0)
	{
		return 1;
	}

	return 0;
}
```