

Novell eDirectory/iMonitor Remote Code Execution Security Advisory

08-Sept-2006

Summary

Novell's HTTP Protocol Stack (httpstk) is a component of iMonitor which provides a web-based interface for management of eDirectory, an LDAP service forming the basis for many of the world's largest identity-management deployments. The code fails to check the length of client-supplied HTTP Host request-header (e.g. Host: www.host.com) values before using them to build a formatted URL into an inadequate, statically-sized buffer on the stack. This condition occurs in a call to `sprintf()` while the server is preparing an HTTP redirect response and can be triggered remotely, before any authentication takes place.

Affected Software

This vulnerability has been confirmed to exist in the following products and corresponding platforms. For additional information, see Novell's website.

Software Title and URL	Version(s)	Platform	Perspective
✘ Novell eDirectory	>= 8.7.3.8	Windows	Remote
✘ Novell eDirectory	>= 8.7.3.8	Linux	Remote
✘ Novell eDirectory	Open Enterprise Server SP2	OES SP2	Remote
✔ Novell eDirectory	N/A (Safe)	Netware	N/A

Impact

Attacker-supplied code can be executed on vulnerable systems with a privilege level equal to the process that loads the httpstk library (the Novell Directory Services process). By default, this is `NT_AUTHORITY\SYSTEM` on Windows and `root` on Linux and Solaris.

Credit and Contact

Michael Ligh
Ryan Smith

michael.ligh@mnin.org
ryan@hustlelabs.com



Details – C++ Pseudo Code

The vulnerable function's logic was examined, and the general structure of the code, depicted in the C++ language, is presented in this section. This code mimics the functions' behavior as accurately as possible in order to illuminate the vulnerability; however, it is only a modest representation of the original source.

The `BuildRedirectURL()` method calls `sprintf()` in order to store the user-supplied HTTP Host request-header value into a 64-byte buffer. The assumed intention of this code is to redirect the client to a valid URL on the host that was specified in the request. Under correct circumstances, `sprintf()`'s length parameter is set to the maximum number of bytes the destination buffer can hold. However, this code utilized the length parameter in order to specify the number of bytes to copy from the Host request-header value, regardless of whether or not the destination buffer is capable of holding it. Therefore, a malicious individual may specify a Host request-header value exceeding 64 bytes, causing a standard stack-based buffer overflow.

```
#define HTTPHDR_HOST_FIELD 211

char szHttp[] = "HTTP";
char szHttps[] = "HTTPS";
char szHttpS[] = "http%s://";
char szCrLf[] = "\r\n";
char szS[] = "s";
char szD[] = ":%d";
char szS_3[] = "%s";
BYTE nullbyte = '\0';

typedef struct SAL_AddrBuf_t {
    short    sin_family;
    u_short  sin_port;
    struct   in_addr  sin_addr;
    struct   in6_addr sin6_addr;
    char     sa_data[42];
} SAL_AddrBuf;

class HRequest
{
public:
    int  SendRedirectRsp(void);
    int  SendHeader(int);
    int  SendNotFoundRsp(void);
    int  SendEndOfContent(void);
    int  RspSetHdrValue(char *, char *);
    bool ReqIsSecureChannel(void);
    char *ReqHdrValue(unsigned int);
    SAL_AddrBuf *ReqHostAddress(void);
private:
    int  BuildRedirectURL(unsigned int, bool, char *);
    char *path;
    HDR_LOOKUP_TBL *ValueTable;
    unsigned int uint;
    int  something;
};
```

```

    SOCKET sock;
    SAL_AdrBuf name;
};

int HRequest::BuildRedirectURL(unsigned int stackid, bool fl_https,
char *redirect_url)
{
    register char *colon, *crlf;
    register size_t length;
    register unsigned short port; // Original just recycled stackid

    // Stack variables
    SAL_AdrBuf SAL;
    char *szHostHdrValue;
    SAL_AdrBuf *pSAL;
    int retval;

    // Zero-out the local SAL_AdrBuf structure
    memset(&SAL,0,66);

    // Fill in the class' SAL_AdrBuf structure with IP and port
    pSAL = ReqHostAddress();
    SAL.sin_family = pSAL->sin_family;

    // This fills in the redirect port in SAL.sin_port
    retval = PStkEnumTransports(stackid, 2, &Callback, &SAL);
    if ((retval != 0) && (retval != SERR_CALLBACK_CANCELLED)) {
        return(0);
    }

    // Obtain a pointer to the user-supplied HTTP Host-Header value
    szHostHdrValue = ReqHdrValue(HTTPHDR_HOST_FIELD);
    if (szHostHdrValue == NULL) {
        return(SERR_INVALID_REQUEST);
    }

    // Exclude colon and/or CRLF from length of host header value
    colon = strchr(szHostHdrValue, ':');
    if (colon == NULL) {
        crlf = strstr(szHostHdrValue, szCrlf);
        if (crlf == NULL) {
            length = strlen(szHostHdrValue);
        }
        else {
            length = crlf - szHostHdrValue;
        }
    }
    else {
        length = colon - szHostHdrValue;
    }

    // Determine if the redirect URL should be https:// or http://
    if (fl_https) {
        redirect_url += sprintf(redirect_url, szHttpS, szS);
    }
    else {
        redirect_url += sprintf(redirect_url, szHttpS, nullbyte);
    }

    // Append the Host-Header value to the redirect URL
    _snprintf(redirect_url, length+1, szS_3, szHostHdrValue);
    redirect_url += length;
}

```

```

// Is IPv4
if (SAL.sin_family == AF_INET) {
    if (retval == ERROR_SUCCESS) {
        if (SAL.sin_port == 0) {
            return(SERR_OBJECT_NOT_FOUND);
        }
        else {
            memcpy((void *)&SAL.sin_addr.s_addr,
                (void *)&pSAL->sin_addr.s_addr, 4);
        }
    }
}

// Is IPv6
else if (SAL.sin_family == AF_INET6) {
    if (retval == ERROR_SUCCESS) {
        if (SAL.sin_port == 0) {
            return(SERR_OBJECT_NOT_FOUND);
        }
        else {
            memcpy((void *)&SAL.sin6_addr.u,
                (void *)&pSAL->sin6_addr.u, 16);
        }
    }
}

// Convert the port from network byte order to host byte order
port = ntohs(SAL.sin_port);

// Append the port to the redirect URL if it is non-standard
if ((fl_https && port == 443) || (!fl_https && port == 80)) {
    return(ERROR_SUCCESS);
}
sprintf(redirect_url, szD, port);
return(ERROR_SUCCESS);
}

int HRequest::SendRedirectRsp(void) {

    register int retval;
    register bool fl_https;

    // Stack variables
    char redirect_url[64];
    char *mемblock;
    unsigned int stackid;

    // Determine if the connection is operating over SSL
    fl_https = ReqIsSecureChannel();
    if (!fl_https) {
        retval = PStkGetProtocolStackByName(szHttps, &stackid);
    }
    else {
        retval = PStkGetProtocolStackByName(szHttp, &stackid);
    }

    if (retval == ERROR_SUCCESS) {

        // Call this function to begin building the redirect URL
        retval = BuildRedirectURL(stackid, fl_https, redirect_url);

        // Remaining code snipped for brevity
    }
}

```

Details - Disassembly

The following disassembly of httpstk.dlm for Windows, version 201.14.24.0, depicts this vulnerability.

HRequest::SendRedirectRsp:

```
.text:62407079 lea    eax, [ebp+request_url]
.text:6240707C mov    ecx, esi
.text:6240707E test   bl, bl
.text:62407080 push  eax
.text:62407081 setz  al
.text:62407084 push  eax
.text:62407085 push  [ebp+stackid]
.text:62407088 call  HRequest::BuildRequestURL
```



HRequest::BuildRedirectURL:

```
.text:62406EF0 push  [ebp+szHostHdrValue]
.text:62406EF3 mov    esi, eax
.text:62406EF5 add    esi, dword ptr [ebp+request_url]
.text:62406EF8 lea   eax, [edi+1]
.text:62406EFB push  offset aS_3
.text:62406F00 push  eax
.text:62406F01 push  esi
.text:62406F02 call  ds:__snprintf
```



Exploit Design

The stack overflow can be triggered with a GET, POST, or HEAD request to a path on the server that produces an HTTP 302 redirect response (mainly /nds and /dhost), when accompanied by an overly-long Host request-header value. By examining the stack segment around the vulnerable function, one can locate and overwrite the return address (Linux) or structured exception handlers (Windows) to gain control of execution. When exploiting this vulnerability, the shell code should be optimized to not contain NULL bytes, colons, carriage returns, or line feeds.

A proof-of-concept exploit has been developed that will reliably exploit all versions of eDirectory on both Windows and Linux, without the need of fingerprinting. This was accomplished by using SEH overwrites and saved-instruction-pointer overwrites at the same time.

The vulnerability's existence may be determined by sending an overly-long HTTP Host-header value containing a colon in the first few bytes. Versions that are not vulnerable will send a redirect containing an IP address, whereas versions that are vulnerable will send a redirect containing the initial bytes before the colon. Furthermore, a web request to an

invalid resource (e.g. http://host/an_invalid_resource) will result in an error page being returned. This error page has been found to be variable depending on the version of eDirectory that is installed.

Defense

The following Snort rules can *assist* in the detection or prevention of attacks against vulnerable systems, however limitations exist and they should never be used in lieu of patching. False negatives may be high if certain evasion techniques are implemented, including the use of non-standard white space and/or carriage returns. Additionally, it is possible to exploit vulnerable systems over the HttpStk SSL listener (if enabled), and this will go undetected by these rules.

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 8028 (msg:"BLEEDING-EDGE Novell
HttpStk Remote Code Execution Attempt /nds"; flow:to_server,established;
content: "/"nds"; depth:10; nocase; content: "|0d0a|Host|3a|"; nocase;
content: "!|0d0a|"; within:56; classtype:web-application-attack; sid:20060808;)
```

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 8028 (msg:"BLEEDING-EDGE Novell
HttpStk Remote Code Execution Attempt /dhost"; flow:to_server,established;
content: "/"dhost"; depth:10; nocase; content: "|0d0a|Host|3a|"; nocase;
content: "!|0d0a|"; within:56; classtype:web-application-attack; sid:20060809;)
```

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 8028 (msg:"BLEEDING-EDGE Novell
HttpStk Remote Code Execution Attempt /nds (linewrap)";
flow:to_server,established; content: "/"nds"; depth:10; nocase;
content: "|0d0a|Host|3a|"; nocase; content: "|0d0a20|"; within:56; classtype:web-
application-attack; sid:20060810;)
```

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 8028 (msg:"BLEEDING-EDGE Novell
HttpStk Remote Code Execution Attempt /dhost (linewrap)";
flow:to_server,established; content: "/"dhost"; depth:10; nocase;
content: "|0d0a|Host|3a|"; nocase; content: "|0d0a20|"; within:56;
classtype:web-application-attack; sid:20060811;)
```

Based on information supplied in the Exploit Design section, it is also possible to detect potential weaknesses on one's network using the Nessus security scanner. A plugin for this vulnerability is provided below.

```
if (description)
{
    script_id(999999);
    script_version ("$Revision: 1.0 $");
    name["english"] = "eDirectory overly-long Host request-header overflow";
    script_name(english:name["english"]);
    desc["english"] = "
Synopsis :
Arbitrary code can be executed on the remote host
Description :
Nessus has determined that the remote host responds similarly
to a vulnerable version of eDirectory. The specific vulnerability
is documented at http://www.mnln.org/advisories/2006\_novell\_httpstk.pdf.
```

```

Solution :
This problem is resolved by applying eDir 8.8.1 ftf for eDirectory
8.8 or edir8739imon.tgz for eDirectory 8.7.3.8.
Risk factor : High";
script_description(english:desc["english"]);
summary["english"] = "Checks for the eDirectory HTTP host request-header
value overflow";
script_summary(english:summary["english"]);
family["english"] = "Web Servers";
script_family(english:family["english"]);
exit(0);
}

include("global_settings.inc");
include("http_func.inc");
include("http_keepalive.inc");

port=get_http_port(default:8028);
if(!get_port_state(port))
exit(0);

hoststr="nessus:" + crap(500);
host=string("Host: ",hoststr,"\r\n");
url_nds=string("GET /nds HTTP/1.1\r\n",host,"\r\n");

sock=open_sock_tcp(port);
if(sock==NULL)
exit(0);

send(socket:sock,data:url_nds);
while(s=recv_line(socket:sock,length:1024)){
if(egrep(pattern:"^Location: https://nessus",string:s))
security_hole(port);
}
close(sock);
exit(0);

```

Remediation

FTF packages and additional information will be available on Novell's website by searching for one or more of the following TIDs: 2974592, 2974600, 2974603.

Event Timeline

08-Sep-2006	Located vulnerability
08-Sep-2006	Drafted this advisory
11-Sep-2006	Notified vendor of vulnerability
20-Oct-2006	Vendor to release FTF packages

Attributions

The good and no-good thumb images were purchased from www.istockphoto.com for one dollar.

The vulnerable software was obtained from:
<http://www.novell.com>

The code snippet was extracted from the disassembly pane of IDA Pro:
<http://www.datarescue.com>

License

This work is licensed under the Creative Commons Attribution 2.5 License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/2.5/> or send a letter to Creative Commons, 543 Howard Street, 5th Floor, San Francisco, California, 94105, USA.

Attribution should be provided both in the form of a link or reference to <http://www.hustlelabs.com>, <http://www.mnin.org>, and a copy of the researchers' names listed under the *Credit and Contact* section of this document.

All other trademarks and copyrights referenced in this document are the property of their respective owners.