Summary

Symark is a Software 500 company and the producer of Symark PowerBroker, a Unix/Linux privilege management solution designed primarily for flexible and centralized access control to the root accounts within a corporate architecture. A stack-based buffer overflow exists in three of the setuid-root binaries (pbksh, pbsh, pbrun) provided with PowerBroker, which allows for any user with local access to escalate to the root level.

Given the nature of the PowerBroker environment, these vulnerabilities can rapidly lead to accentuated circumstances and the compromise of root accounts on all Unix/Linux systems (including the master), in a corporate network, provided the systems are also running PowerBroker (they should be, that’s the point) by using the same three PowerBroker utilities or specially-crafted attack tools.

Affected Versions

These vulnerabilities apply to PowerBroker up to and including 5.0.1. Symark has released a service pack for 2.8, 3.0, 3.2, 3.5, 4.0, and 5.0/5.0.1. For more information, including how to install the service packs and how to determine if an environment has been affected, please consult the vendor security update: [www.symark.com/support/PBFeb2008Announcement.html](http://www.symark.com/support/PBFeb2008Announcement.html).

Credit and Contact

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Details

When PowerBroker clients (pbksh, pbsh, pbrun) initiate a command request to the master, a protocol/version announcement is exchanged between the two systems over the network. An example of this announcement is shown below, with the name highlighted to indicate that it differs between programs, depending on if pbksh, pbsh, or pbrun is used.

```plaintext
#!/Proto
#Pro
version=4.0.8-03,MPX,MPX2,LOGSRV,[…]
```

The name is not hard-coded in each respective program, rather it is taken from the argv[0] command-line argument at runtime. It is appended, via strcat(), to the announcement string, which is stored in a statically-sized 1048-byte stack buffer. By supplying a specially-crafted value for argv[0] when invoking one of the three setuid-root binaries, an attacker can gain control of execution when the function containing the stack buffer returns.
Exploit Design

The three PowerBroker binaries are setuid-root because they need to create a TCP-socket with the master using a reserved client/source port (see allownonreservedconnections setting). The process’ user id (uid) is switched to that of the calling user after creation of the socket, which is before the buffer overflows. However the effective user id (euid) is allowed to remain the same. Since the program is setuid, it is possible to leverage the root euid to restore a root uid, thus allowing an attacker to then gain a privileged shell.

The output below shows the parameters to setrestuid (in the middle), along with the before (left) and after (right) status of the process privileges.

```
[mike@fedoravm ~]$ ./pbexploit_32bit_x86
[setresuid] 500, 0, 0 (-1, 500, -1) 500, 500, 0
[setresuid] 500, 500, 0 (-1, 0, -1) 500, 0, 0
[setresuid] 500, 0, 0 (0, 0, 0) 0, 0, 0 Called from attack code
[root@fedoravm ~]$
```

The design should avoid the use of system() when spawning a shell (due to issues with setuid), NULL bytes due to issues with strcat(), and forward slashes due to path-related string operations. If the desired actions cannot be completed in 1024 bytes of shellcode or less, then a searching algorithm can be implemented to locate pre-staged code in memory.

A greedier design than the simple root shell could include a payload that immediately begins compromising other hosts by leveraging the ability for PowerBroker clients to run commands on other (remote) PowerBroker clients (see allowremotejobs default setting). By cycling through the IP addresses on the target subnet from the attack code, it would be possible to compromise hundreds or thousands of corporate systems in a matter of seconds.

This functionality can also be used to transfer and install a rootkit on the master using the same network ports as legitimate PowerBroker traffic. By then designing an “in-socket” rootkit for this purpose, it would be possible to gain control of all root accounts in the corporate architecture by coordinating with the compromised master over the covert channel.
Attributes

Symark, as reviewed by Information Security Magazine in October 2007. Symark addressed this vulnerability quickly and handled disclosure with professional care.

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