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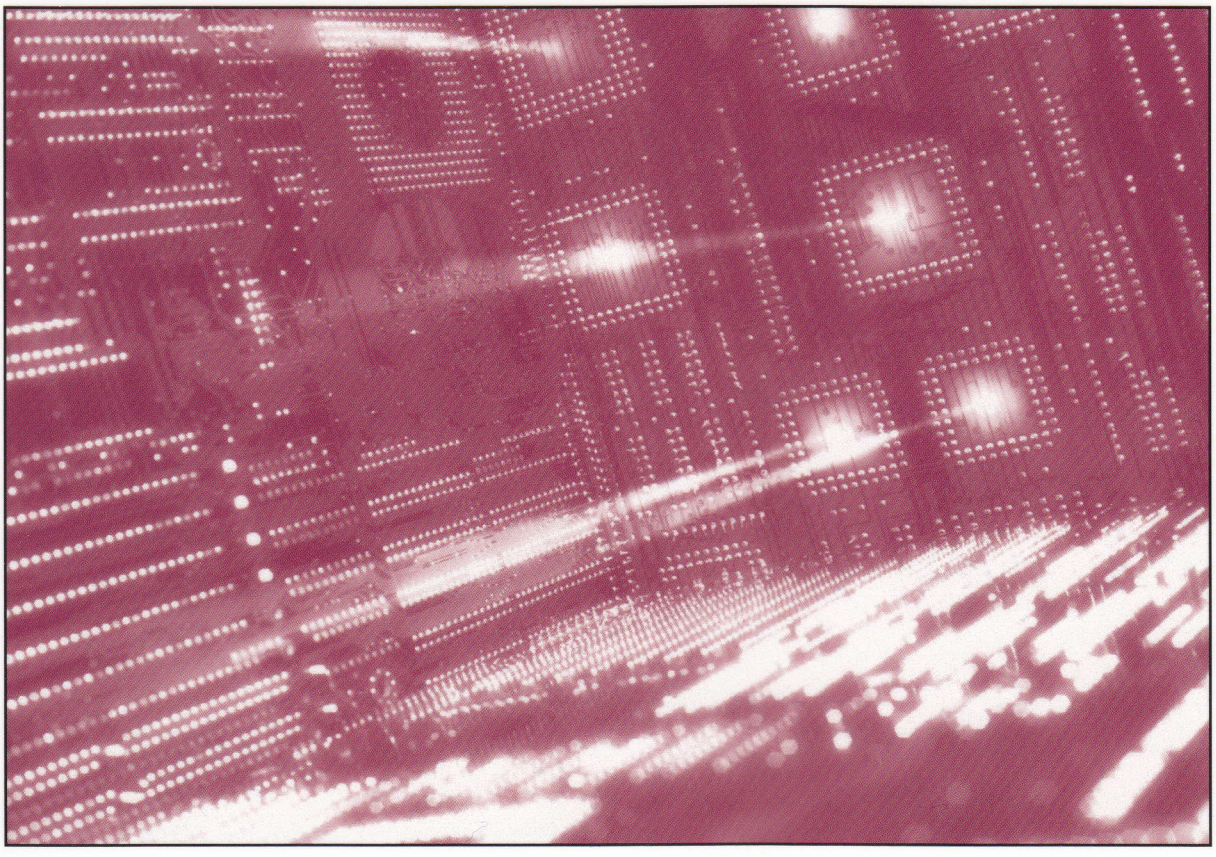

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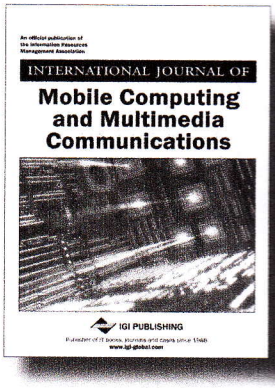

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Reconnaissance Attack on IPv6 to IPv4 Tunneling

Nazrulazhar Bahama, Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia

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ABSTRACT

Internet Protocol version 6 (IPv6) is created to occupy the insufficient current Internet addresses. Consequently this significant contribution offers huge number of Internet addresses. Besides, the security also has been improved to challenge today threats in competent on IPv6 network. As alternative, an automatic tunneling was introduced along with other transition mechanisms to ensure smooth implementation on existing network. However, it's believed that the implementation of automatic tunneling has altered the form of the IPv4 threats. Then the gained information from this mechanism is exploited to attempt the target network. As a concern, this paper thoroughly describes on potential of reconnaissance attack reach through automatic tunneling named 6to4 Tunneling. The preference development tools and networking defense mechanism suite, is setup to conduct proposed attack method under 6to4 tunnel testbed environment. As a result, the attacking method is feasible to attempt and 6to4 tunnel showed their influence on the achievement of DoS attack in current internet.

Keywords: *6to4 Tunneling, Dual Stack, Internet Protocol Version 6 (IPv6), Protocol Version 4 (IPv4), Protocol-41*

INTRODUCTION

IPv6 is a new protocol of internet was developed by Internet Engineering Task Force (IETF) to replace the existing protocol (Raicu & Zeadally, 2003). Initially, the deployments of previous researches were to identify constraints that may occur in IPv6. Throughout years, Transition Mechanism (TM) has been inspired in order to ensure a successful integration of IPv6 into an existing network (AlJaafreh et al., 2008; Narayan & Tauch, 2010). As referred to (Waddington & Fangzhe, 2002), TMs are identified into three main categories based on their operation and the way of their implementation: dual stack mechanisms (Durand, 2001; Hirorai & Yoshifuji, 2006), tunneling mechanisms (Vazao et al., 2004; Waddington & Fangzhe, 2002), and translation mechanisms (Grosse & Lakshman, 2003; Kawarasaki et al., 2003). Among of these mechanism, tunneling is widest implemented nowadays.

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Since IPv6 in IPv4 tunnel is established between Node_A and Node_B, we may name it as *Tunnel (A,B)* and packet sent through this tunnel can be write as:

$$\textit{Tunnel}\ (A,B) = AB = A{:}[A_4 B_4\ payload_4] \blacktriangleright [A_4 B_4\ payload_4]{:}B \quad (3)$$

An IPv6 packet encapsulated in an IPv4 payload with source and destination IPv6 address Y_6 and X_6 is written as:

$$payload_4 = Y_6 X_6\ payload_6 \quad (4)$$

Then, if (2) is communicate through *Tunnel (A,B)*, we may write as:

$$\text{Tunnel}\ (A,B) = A{:}[A_4 B_4\ \text{payload}_4] \blacktriangleright [A_4 B_4\ \text{payload}_4]{:}B$$
$$\textit{Tunnel}\ (A,B) = A{:}[A_4 B_4\ [Y_6 X_6\ payload_6]] \blacktriangleright [A_4 B_4\ [Y_6 X_6\ payload_6] \quad (5)$$

Thus, this study is using the above interpretation on a real live tunneled network to observe its structure in general.

METHOD

This section describes the development of passive mode reconnaissance attack's model to address security issues of the 6to4 tunnel. As stated before, reconnaissance attack operates in Network layer which seeking active nodes in a same subnet. In this experiment, the implementation is conducted by looking into 6to4 tunneling traffic or specifically on IPv4 protocol type 41 traffic. The major goal is to identify the end nodes of each existing tunnels. The process involved capturing and peeling the network traffic that could obtain the useful information so that easy to commit the further attacks. The important information in this implementation is getting the source and destination of IPv4 addresses.

Refer to Figure 3, this kind of silent attack is through all protocol 41 traffics between node A and node B. Each node on the IPv6 network is communicated with other nodes on Dual Stack network. If each of the traffic flow is interpreted into the aforementioned equation, the structure of the traffics through 6to4 tunnels can be presented as follows.

By considering equation (5), we may write:

YW (Node_Y to Node_W)

$$\textit{Tunnel}(A,B) = A{:}[A_4 B_4\ [[Y_6 W_6\ payload_6]]] \blacktriangleright [A_4 B_4\ [Y_6 W_6\ [payload_6]]]{:}B \quad (6)$$

YX (Node_Y to Node_X)

$$\textit{Tunnel}(A,B) = A{:}[A_4 B_4\ [Y_6 X_6\ [payload_6]]] \blacktriangleright [A_4 B_4\ [Y_6 X_6\ [payload_6]]]{:}B \quad (7)$$

Then, to sight the addresses at ends of tunnel, it can be finding by $(6) \cap (7) = A_4 B_4$ and $payload_6$. Since the purpose of the attack is to find the end of the tunnel node addresses, so $payload_6$ is neglected.

This threat have been developed using free downloaded tool, Scapy because of the ability to permit building, sending, receiving and analyzing packets (Burns *et al.*, 2007). Then, a sequence of schematic flow has been designed as a process of Reconnaissance attack development as in Figure 2. Overall, this development selected only packet types 41 that carry the information about actives 6to4 tunnel end nodes and appear preferred information's into log file.

Here, the details explanation of the process involved is as follows.

Firstly, attacker filtered all traffics were on the IPv6 encapsulation protocol (IPv4 protocol-41):

```
if pkt[IP] and pkt[IP].proto==41
```

Then, the first byte of the payload is a '6' identified in hexadecimal (IPv6 packet):

Figure 2. Flow chart of reconnaissance attack development process

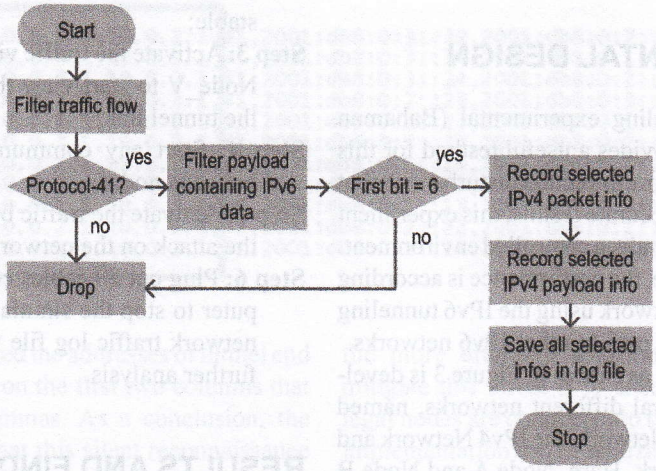
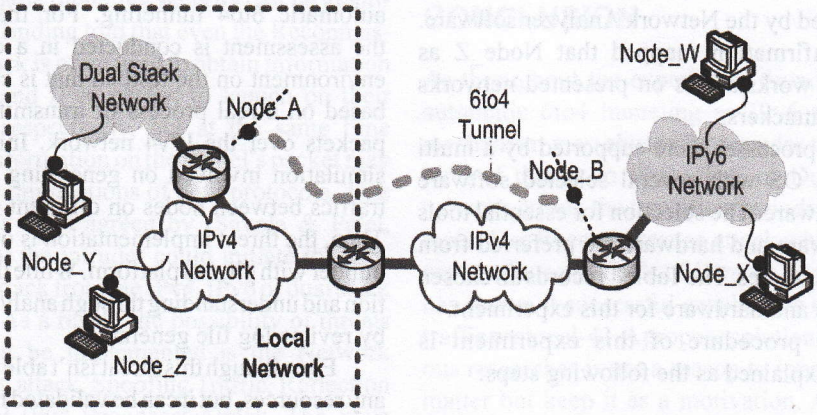


Figure 3. Testbed developed according to the desired environment



if pkt[IP].payload and hexlist(pkt[IP].payload)[0][0] == "6"

Next, record the ip protocol value and the outer source and destination IPv4 address:

```
v4src = str(pkt[IP].src)
v4dst = str(pkt[IP].dst)
v4p = str(pkt[IP].proto)
```

After that, the inner source and destination IPv6 address is taken:

```
v6src = v6tostr(hexlist(pkt[IP].payload)[8:24])
v6dst = v6tostr(hexlist(pkt[IP].payload)[24:40])
```

Lastly, the traffic flow in log file is save as below:

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