

## Setting up an IPv6 based home LAN

After successfully installing your IPv6 based internet connection, you provided the IPv6 network connection for a given device – typically a computer - to access IPv6 content. For example: <http://www.kame.net/> , <http://ipv6.freemail.hu/>

You can check the IPv6 internet-connection also on the following webpage: [http://www.ipv6forum.com/test\\_ipv6.php](http://www.ipv6forum.com/test_ipv6.php).

During the IPv6 pilot Magyar Telekom provides an opportunity for the users to assign public IPv6 addresses to further devices connected to their local network (LAN). This means that it is possible to give public IPv6 addresses to additional computers. A precondition to this is to request an IPv6 address range at the IPv6 registration site (<https://ipv6regisztracio.telekom.hu/>). When posting the request you will need the so called DUID (DHCPv6 Unique ID) of your computer, which you can identify as follows:

- In case of Microsoft Windows Vista/Windows7: Please, start the IPv6 dialer then type `ipconfig /all` command in the command line window. The required set of characters can be found in the dialer PPP-adapter information within the “DHCPv6-subscriber DUID” line.

```

C:\Windows\system32>
C:\Windows\system32>
C:\Windows\system32>ipconfig /all

Windows IP konfiguráció

Állomásnév . . . . . : Vista-IPv6
Elsődleges DNS-utótag . . . . . :
Gsmópcím típus . . . . . : Hibrid
IP-átváltás engedélyezve . . . . . : Nem
WINS-proxy engedélyezve . . . . . : Nem
DNS-utótag keresési listája . . . . . : jupiter-dhcpv6-pool
dev

PPP-adapter gipsz.jakab@ipv6.t-online.hu:

Kapcsolatspecifikus DNS-utótag. . . . . : jupiter-dhcpv6-pool
Leírás. . . . . : gipsz.jakab@ipv6.t-online.hu
Fizikai cím . . . . . :
DHCP engedélyezve . . . . . : Nem
Automatikus konfiguráció engedélyezve : Igen
IPv6-cím. . . . . : 2001:4c48:24:ff00:82d:f61e:75db:89bc(Kívánt)
Kapcsolati szintű IPv6-cím . . . . . : fe80::82d:f61e:75db:89bc%17(Kívánt)
Alapértelmezett átjáró . . . . . : fe80::206:52ff:faa3:8c00%17
DHCPv6-ügyfél DUID azonosítója . . . . . : 296887840
DNS-kiszolgálók . . . . . : 2001:4c48:1::1
NetBIOS a TCP/IP felett. . . . . : Letiltva
Kapcsolatfüggő DNS-utótagok keresési listája:
jupiter-dhcpv6-pool
dev

Ethernet-adapter Helyi kapcsolat:

Kapcsolatspecifikus DNS-utótag. . . . . :
Leírás. . . . . : Realtek RTL8139/810x termékcsaládba tartozó gyors Ethernet hálózati adapter
Fizikai cím . . . . . : 00-17-31-E6-77-AD
DHCP engedélyezve . . . . . : Igen
Automatikus konfiguráció engedélyezve : Igen
IPv6-cím. . . . . : 2001:4c48:24:ff00:82d:f61e:75db:89bc(Kívánt)
Kapcsolati szintű IPv6-cím . . . . . : fe80::a001:76cc:a47b:61f6%10(Kívánt)
Automatikus konfigurált IPv4-cím. . . . . : 169.254.97.246(Kívánt)
Alhálózati maszk . . . . . : 255.255.0.0
Alapértelmezett átjáró . . . . . :
DNS-kiszolgálók . . . . . : fec0:0:0:ffff::1%1
fec0:0:0:ffff::2%1
fec0:0:0:ffff::3%1
NetBIOS a TCP/IP felett. . . . . : Engedélyezve

Protokollbújtató adapter Helyi kapcsolat*:

Adathordozó állapota. . . . . : Adathordozó leválasztva
Kapcsolatspecifikus DNS-utótag. . . . . :
Leírás. . . . . : isatap.{1BBB8D07-7E90-454F-935A-570A5574F3C1}
Fizikai cím . . . . . : 00-00-00-00-00-00-00-E0
DHCP engedélyezve . . . . . : Nem
Automatikus konfiguráció engedélyezve : Igen

C:\Windows\system32>
C:\Windows\system32>
  
```

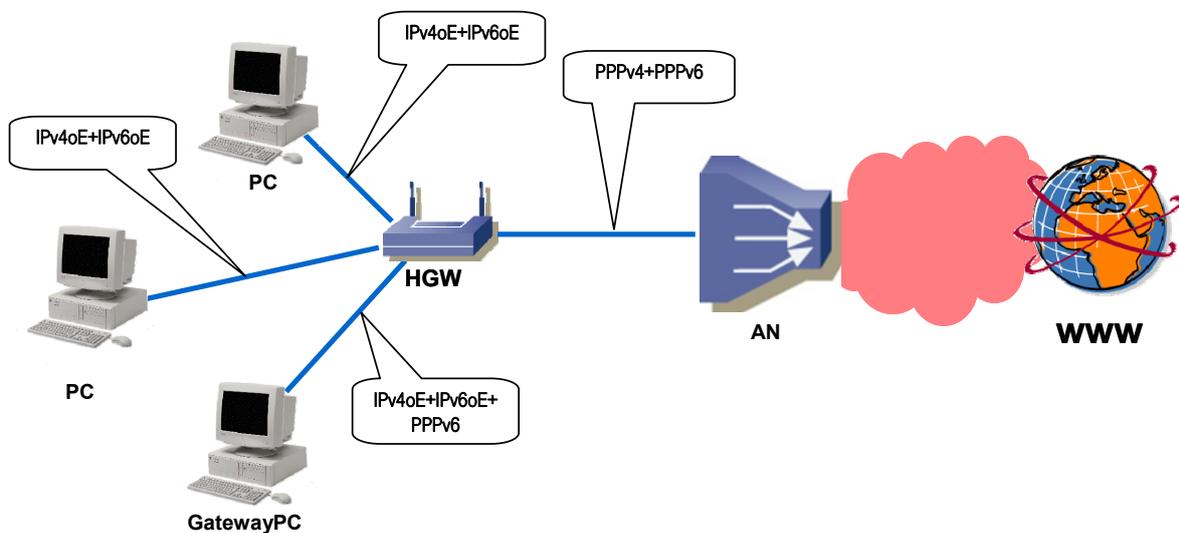
(Note: the DUID can also be found in the Registry database, however this is only advised for advanced windows users. For this, type `regedit` in the command line to open the database and search for “DUID”.

The information you are looking for is the Dhcpv6 DUID value within the \HKEY\_LOCAL\_MACHINE\SYSTEM\ControlSet001\Services\Tcpip6\Parameters line.)

- In case of an Ubuntu Linux operating system it is necessary to establish a live PPPv6 connection, and to configure and run the WideDHCPv6 client described in the present document. With this you can look for the ID in question. Please, enter the `ubuntu@ubuntu:~$ sudo dhcp6c -idDf ppp0` command, as a result of which the DUID appears on the screen.

The task of the device establishing the IPv6 PPPoE connection is to request the public LAN address range dedicated to you – from the Magyar Telekom network using the so called DHCPv6 protocol, and to assign IPv6 addresses from the dedicated range to the devices connected to you home network.

A possible arrangement is shown in the following figure:



### **Important!**

The Microsoft Windows XP operating system, similarly to its lack of IPv6 PPPoE capability, does not support the DHCPv6-PD client function either, however it can connect to an already operational IPv6 gateway and through that to the IPv6 network. The detailed description of the required settings can be found a separate Instruction, also downloadable from the <http://www.telekom.hu/ipv6/> page.

In case of Microsoft Windows Vista operating system the configuration steps described in the [IPv6 routing settings for Microsoft Vista operating system](#) chapter should be followed.

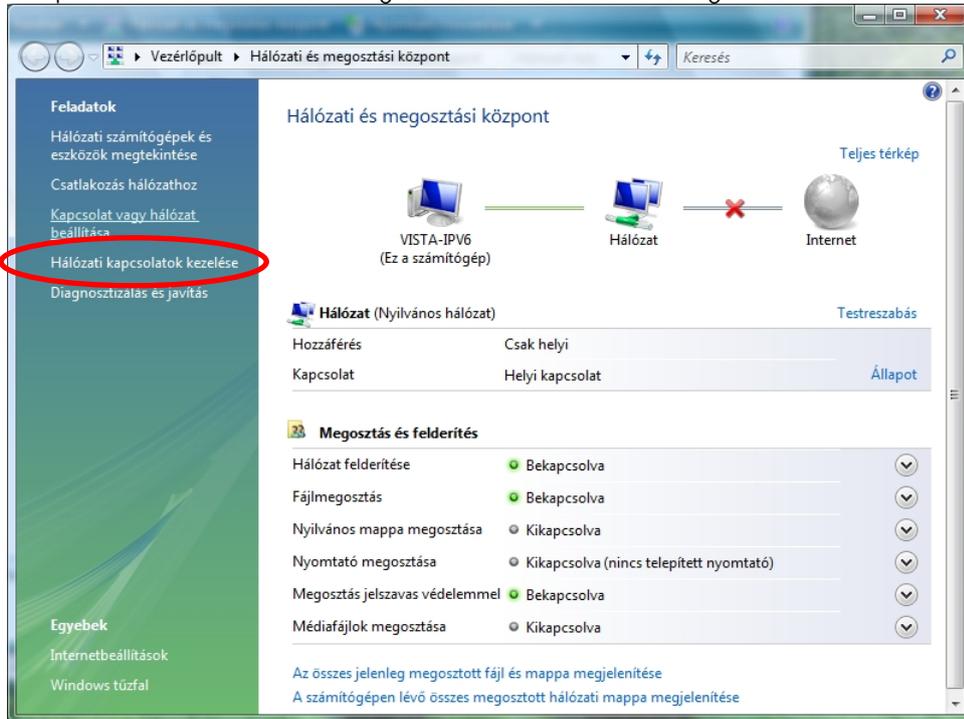
For Linux systems the required settings can be found in the [IPv6 routing settings for Linux operating system](#) chapter.

The Microsoft Windows Vista or Linux based computers configured as described in the above mentioned chapters serve as routers/gateways and allow for connecting further home computers. For this, the IPv6 protocol needs to be enabled on those computers.

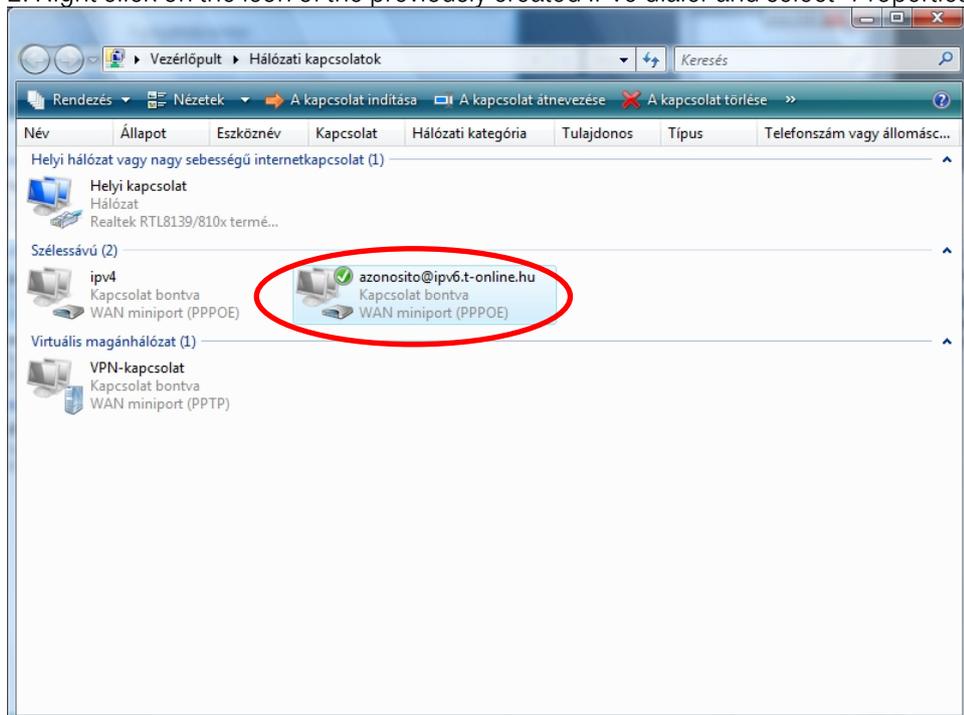
## IPv6 routing settings for Microsoft Windows Vista operating system

In the gateway computer used in the example, there is one network card (eth0) which concurrently faces the IPv6 network and the home IPv4 subnet. Microsoft Windows Vista (similarly to its predecessor) is capable of sharing its internet access with other user devices. For this the “Sharing the internet connection” function should be enabled as follows:

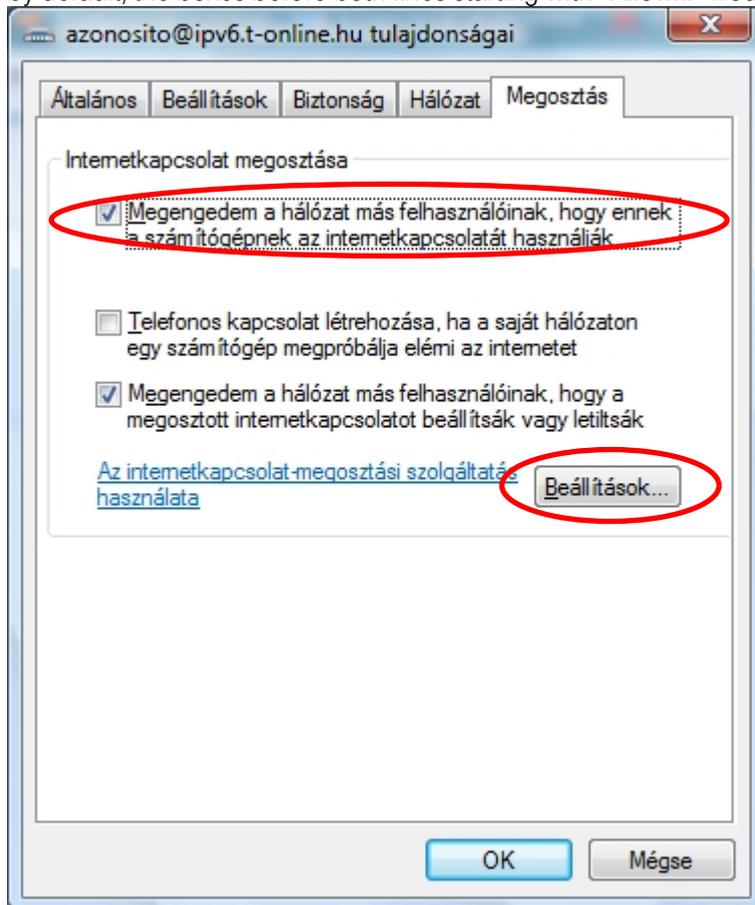
1. Open the Network and Sharing Center and click on “Manage network connections”.



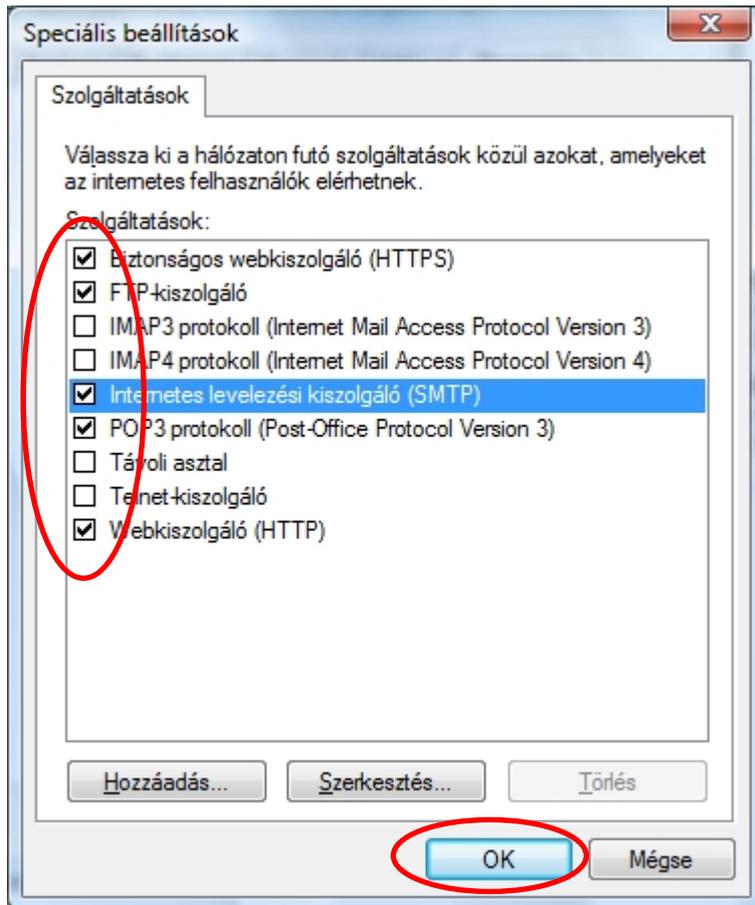
2. Right click on the icon of the previously created IPv6 dialer and select “Properties”.



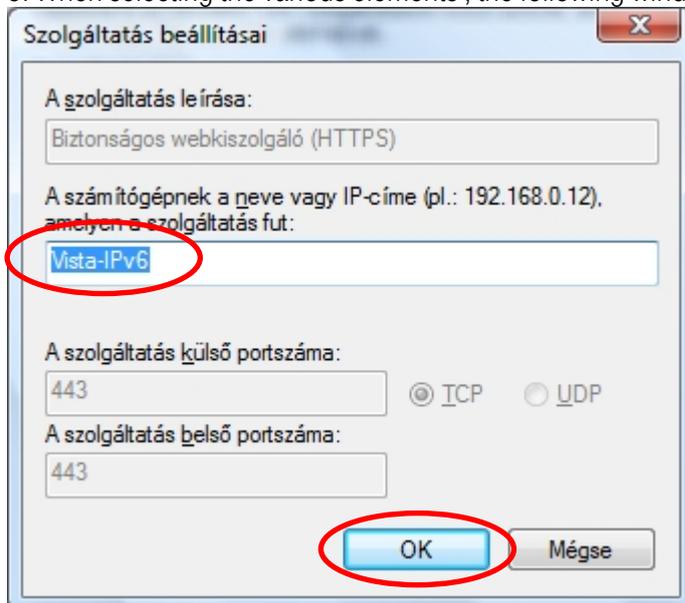
3. Click on the „Sharing” tab and select the upper row starting with “Allow other network users ...” (now, by default, the boxes before both lines starting with “Allow...” would be ticked).



4. Click on “Settings...” to enable or disable services accessible to other computers on the network. After you selected which services you would like to allow other network endpoints to access, please, click on OK.

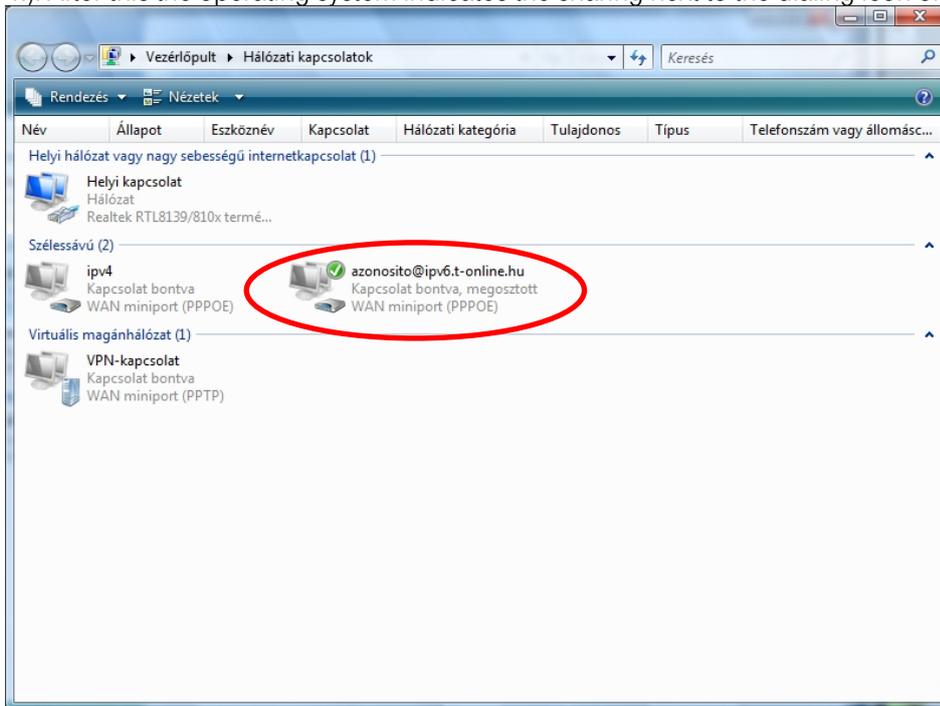


5. When selecting the various elements, the following window pops up.

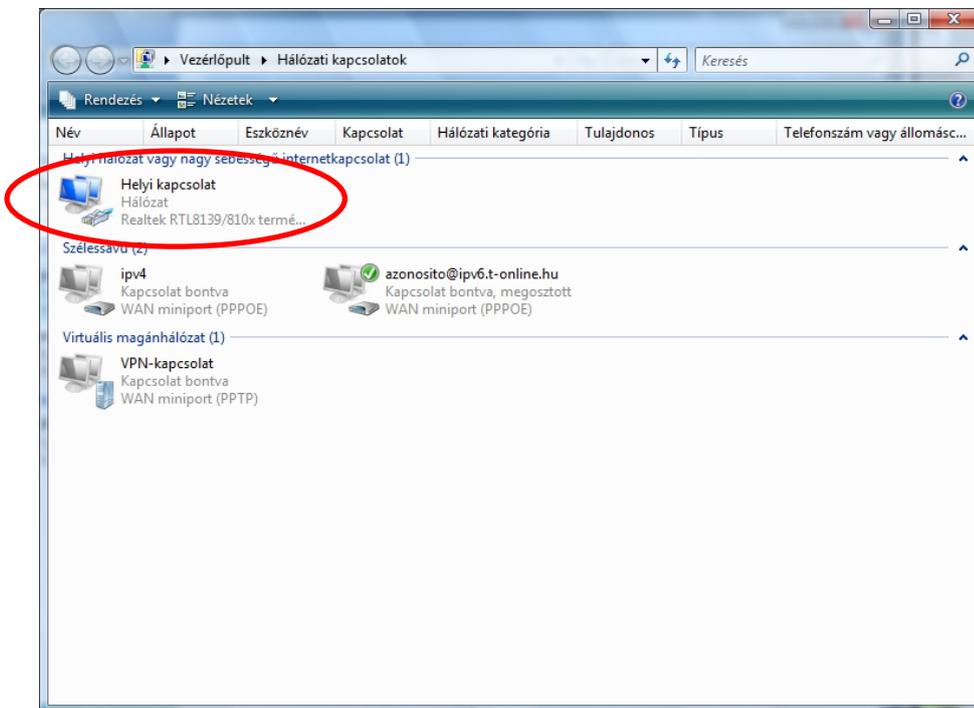


If the computer name is correct, please, click on OK.

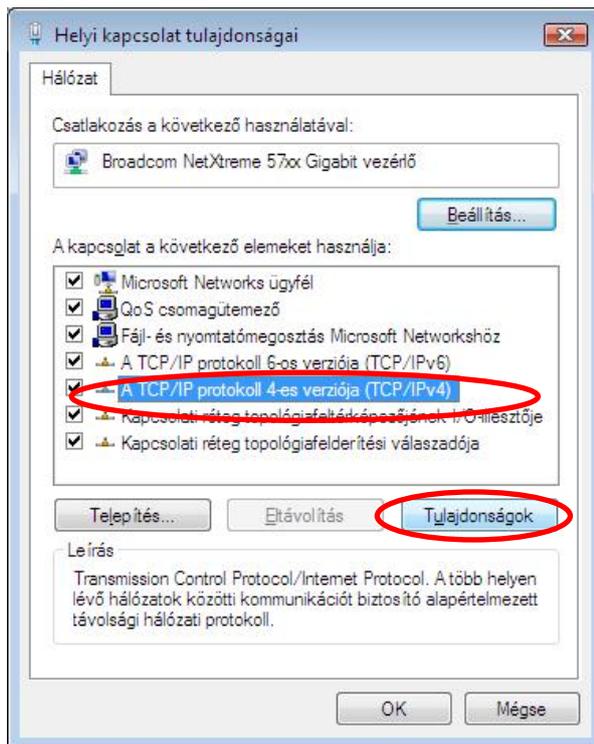
6. After selecting the required services click on the OK button in the “Advanced Settings” window (section 4.). After this the operating system indicates the sharing next to the dialing icon of the shared connection.



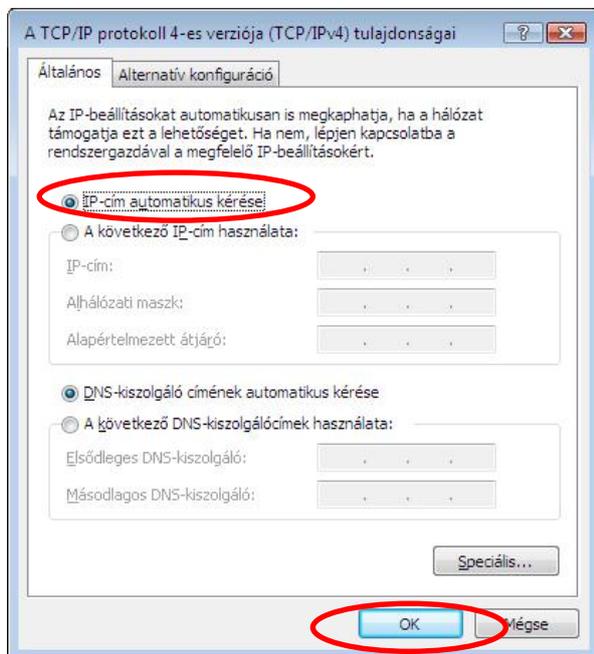
7. Please, right click on the “Local Connection” icon and select “Properties”



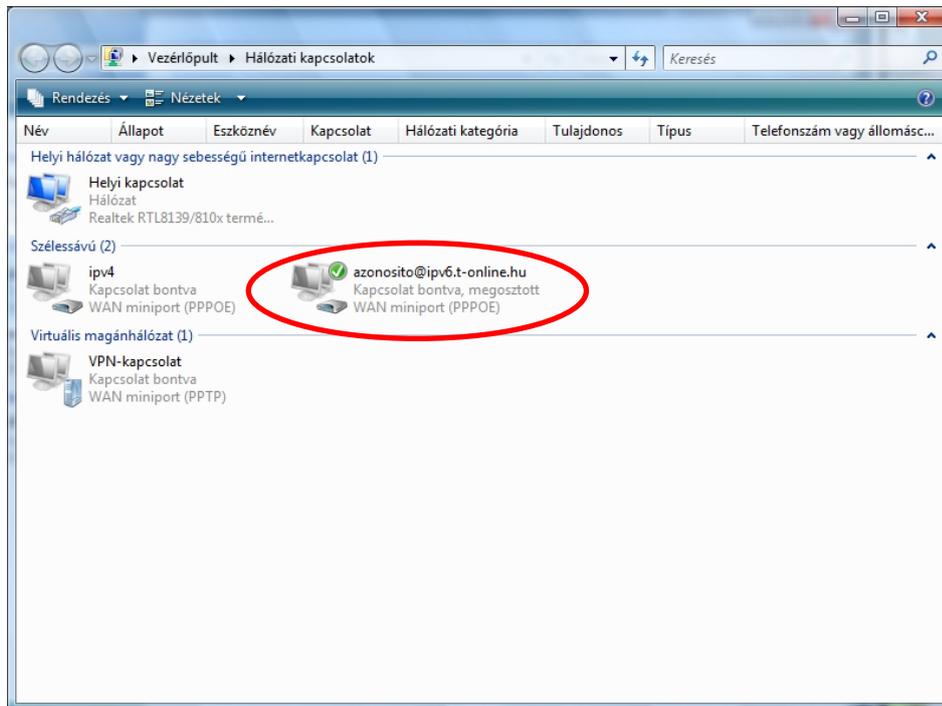
8. In the appearing window select the “TCP/IP protocol version 4” line and click on “Properties”.



9. Select “Automatic IP address request”, then finish by clicking on the “OK” button.



10. After closing the “Local Connection Properties” window, you can initiate setting up the IPv6 connection by clicking on the dialer icon you created.



After the connection has been successfully established, the computers connected to your LAN can already use the shared internet access of the host computer.

To perform a check, enter `ipconfig /all` into the command line, and the following lines should appear on the dialer PPP-adapter information screen (naturally, your “IPv6–address” will be somewhat different):

```

C:\Windows\system32>ipconfig /all

Windows IP konfiguráció

Állomásnév. . . . . : PCA
Elsődleges DNS-utótag . . . . . :
Csomóponttípus. . . . . : Hibrid
IP-útválasztás engedélyezve . . . . . : Nem
WINS-proxy engedélyezve . . . . . : Nem

PPP-adapter azonosito@ipv6.t-online.hu:

Kapcsolatspecifikus DNS-utótag. . . . . :
Leírás. . . . . : azonosito@ipv6.t-online.hu
Fizikai cím . . . . . :
DHCP engedélyezve . . . . . : Nem
Automatikus konfiguráció engedélyezve . . . . . : Igen
IPv6-cím. . . . . : 2001:4c48:100:164:4fa:c9f9:d80f:6b85<Kívánt>
Kapcsolati szintű IPv6-cím . . . . . : fe80::4fa:c9f9:d80f:6b85%18<Kívánt>
Alapértelmezett átjáró . . . . . : fe80::zwe:acrr:reb7:d81b%18
DHCPv6 IAID . . . . . : 311360544
DHCPv6-ügyfél DUID azonosítója . . . . . : 00-01-00-01-11-FA-2F-54-00-12-3F-8C-77-66
DNS-kiszolgálók . . . . . : 2001:4c48:1::1
NetBIOS a TCP/IP felett. . . . . : Letiltva

Ethernet-adapter Helyi kapcsolat:

Kapcsolatspecifikus DNS-utótag. . . . . :
Leírás. . . . . : Broadcom NetXtreme 57xx Gigabit vezérlő
Fizikai cím . . . . . : 00-12-3F-8C-77-66
DHCP engedélyezve . . . . . : Igen
Automatikus konfiguráció engedélyezve . . . . . : Igen
Kapcsolati szintű IPv6-cím . . . . . : fe80::48ad:56b1:1ae9:b751%10<Kívánt>
IPv4-cím. . . . . : 192.168.1.64<Kívánt>
Alhálózati maszk . . . . . : 255.255.255.0
Bérleti jog kezdete . . . . . : 2009. október 22. 10:36:22
Bérleti jog vége . . . . . : 2009. október 22. 11:36:22
Alapértelmezett átjáró . . . . . : 192.168.1.254
DHCPv6 IAID . . . . . : 251662911
DHCPv6-ügyfél DUID azonosítója . . . . . : 00-01-00-01-11-FA-2F-54-00-12-3F-8C-77-66
DNS-kiszolgálók . . . . . : 192.168.1.254
NetBIOS a TCP/IP felett. . . . . : Engedélyezve

Protokollbűjtató adapter Helyi kapcsolat*:

Adathordozó állapota. . . . . : Adathordozó leválasztva
Kapcsolatspecifikus DNS-utótag. . . . . :
Leírás. . . . . : isatap.{65DFA2E1-F95E-4233-AB7C-3C24536CED4D}
Fizikai cím . . . . . : 00-00-00-00-00-00-E0
DHCP engedélyezve . . . . . : Nem
Automatikus konfiguráció engedélyezve . . . . . : Igen

Protokollbűjtató adapter Helyi kapcsolat* 6:

Kapcsolatspecifikus DNS-utótag. . . . . :
Leírás. . . . . : Teredo Tunneling Pseudo-Interface
Fizikai cím . . . . . : 02-00-54-55-4E-01
DHCP engedélyezve . . . . . : Nem
Automatikus konfiguráció engedélyezve . . . . . : Igen
IPv6-cím. . . . . : 2001:0:d5c7:a2d6:308b:1bbc:3f57:febf<Kívánt>
Kapcsolati szintű IPv6-cím . . . . . : fe80::308b:1bbc:3f57:febf%11<Kívánt>
Alapértelmezett átjáró . . . . . :
NetBIOS a TCP/IP felett. . . . . : Letiltva

Protokollbűjtató adapter Helyi kapcsolat* 7:

Adathordozó állapota. . . . . : Adathordozó leválasztva
Kapcsolatspecifikus DNS-utótag. . . . . :
Leírás. . . . . : 6T04 Adapter
Fizikai cím . . . . . : 00-00-00-00-00-00-E0
DHCP engedélyezve . . . . . : Nem
Automatikus konfiguráció engedélyezve . . . . . : Igen

C:\Windows\system32>

```

Further information can be seen by clicking on the “Sharing the internet connection” link in the window shown in section 3. (Microsoft Help).

## ***IPv6 routing settings for Linux operating system***

The settings are described for Ubuntu linux operating system but the same parameters should be used for other Linux distributions as well. As a result, an IPv6 virtual gateway is set up, which allocates the dedicated IPv6 range further to the subnet using the so called 'prefix delegation' method.

In the gateway computer there is one network card (eth0), which concurrently faces the IPv6 network and the home IPv4 subnet.

Important steps:

- Installing the required packages (wide-dhcpv6-client, Router Advertisement Daemon)
- Testing IPv6 operation (to check whether all packages have been installed)
- Setting up the PPPoE connection
- Routing Table settings
- Request address range for the home network with DHCPv6-PD (used for the eth0 interface)
- Router Advertisement daemon on the subnet

### **Installation of the required packages**

The packages required for IPv6 operation can be installed by typing the following command in the Terminal window:

- `ubuntu@ubuntu: ~$ sudo apt-ubuntu@ubuntu: ~$ sudo apt-get install wide-dhcpv6-client` - This is the DHCPv6 client which allows for prefix delegation and host configuration via IPv6 protocol.
- `get install radvd` - This package contains the Router Advertisement Daemon used for allocating the addresses, obtained through prefix delegation, to the home subnet.

### **Testing IPv6 operation**

With the following commands you can check if the IPv6 protocol files really exist:

```
ubuntu@ubuntu: ~$ sudo test -f /proc/net/if_inet6 && echo "Running kernel is IPv6 ready"
```

Upon successful command run, the output is:

```
Running kernel is IPv6 ready
```

```
ubuntu@ubuntu: ~$ sudo /sbin/ifconfig -? 2>& 1 | grep -qw 'inet6' && echo "utility 'ifconfig' is IPv6-ready"
```

Upon successful command run, the output is:

```
utility 'ifconfig' is IPv6-ready
```

```
ubuntu@ubuntu: ~$ sudo /sbin/route -? 2>& 1 | grep -qw 'inet6' && echo "utility 'route' is IPv6-ready"
```

Upon successful command run, the output is:

```
utility 'route' is IPv6-ready
```

### **Setting up the PPPoE connection**

Please, make the settings for and start the PPPv6 dialer as described in the "Operation system settings (establishing PPPoEv6 connection)" document:

```
ubuntu@ubuntu: ~$ sudo pon dsl-provider
```

## Routing Table settings

Although Linux generally makes the right routing table settings, for safety's sake, please, run the following command (each time you restart our computer after establishing the PPPv6 connection):

```
ubuntu@ubuntu: ~$ sudo route add -A inet6 default dev ppp0
```

## Requesting DHCPv6 address

For this step, please enter the following commands:

```
ubuntu@ubuntu: ~$ sudo sysctl -w net.ipv6.conf.all.forwarding=1
```

The command prompts the system to operate as a gateway.

Important: upon restart, you have to type in the command again!

```
ubuntu@ubuntu: ~$ sudo gedit /etc/wide-dhcpv6/dhcp6c.conf
```

After opening the editor, please, modify the file as follows, then save it.

```
# Default dhcp6c configuration: it assumes the address is autoconfigured using
# router advertisements.

interface ppp0{
    send ia-pd 0;
    request domain-name-servers, domain-name;
    send domain-name-servers, domain-name;
};

id-assoc pd {
    prefix-interface eth0{
        #az sla-id értéke 0-255-ig tetszőleges decimális szám lehet
        #a PD-nél kapott hexadecimális /56 címét ezzel egészítjük ki 64 bitre
        #jelen esetben ez 4
        sla-id 4;
        sla-len 8;
    };
};
```

```
ubuntu@ubuntu: ~$ sudo dhcp6c -d -D -f ppp0
```

This command, which starts the dhcp6 client, should be entered at each boot time.

(The `-d -D -f` command-parameters should only be typed in if you would like to see what happens as a result of the command, however, the program runs even without these. In case of proper operation the state=REQUEST expression is shown. Upon longer operation the DHCP request is renewed from time to time, indicated by the expression RENEW. If you launched the command with command-parameters, please, open another Terminal window for further work.)

In case of proper operation a Global address appears on the eth0 device. Type in the following command:

```
ubuntu@ubuntu: ~$ sudo ifconfig eth0
```

Now you should see something like this (the important part is highlighted):

```
eth0      Link encap:Ethernet  Hwaddr 00:17:31:e6:77:99
          inet6 addr: 2001:4c48:100:164:9c3a:b206:c4e0:9e86/64 Scope:Global
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

```
Interrupt:20 Base address:0xdc00
```

## Router Advertisement daemon settings for the subnet

Using the first 64 bits of the IPv6 address indicated above with red color (in this example it is 2001:4c48:100:51ab: ) please, modify the /etc/radvd.conf file as follows:

```
ubuntu@ubuntu: ~$ sudo gedit /etc/radvd.conf
```

```
interface eth0
{
  AdvSendAdvert on;
  AdvLinkMTU 1500;
  MaxRtrAdvInterval 30;

  prefix 2001:4c48:100:164::/64
  {;};
```

```
ubuntu@ubuntu: ~$ sudo radvd (to be typed in at every boot time)
```

Proper radvd operation, that is the parameters of the router announcements can be checked with the radvdump command.

Now the settings for the Ubuntu Linux based computer are complete, from now on the configured computer serves as an IPv6 gateway for other IPv6 capable computers connected to the home network. (Naturally, It can still be used as a simple client, other operational parameters remain unchanged!)

## Potential problems and ways to resolve them

Upon refreshing the Ubuntu Linux 9.0.4 operating system it may occur that the interfaces disappear, and the *ifconfig* command does not show any live connection. The reason for this problem is that the /etc/network/interface file is overwritten for manual settings.

To reset, open the file, and change the highlighted word (*manual*) to *dhcp*, save the file under the same name and log out of the program.

```
ubuntu@ubuntu: ~$ sudo gedit /etc/network/inteface
```

```
auto lo
iface lo inet loopback

ifacedsl-provider inet ppp
pre-up /sbin/ifconfig eth0 up # line maintained by pppoeconf
provider dsl-provider

auto eth0
iface eth0 inet manual # manual helyett dhcp legyen
```

The pan0, and/or the pan0:avahi interfaces may appear.

These can be turned off with the following command:

```
ubuntu@ubuntu: ~$ sudo ifconfig pan0 down
```

Upon establishing PPPoE connection no IPv6 address is delegated.

Break all PPPoE connections:

```
ubuntu@ubuntu: ~$ sudo poff -a
```

Delete the unnecessary interfaces (pan0):

```
ubuntu@ubuntu: ~$ sudo ifconfig pan0 down
```

Then restart the PPP connection:

```
ubuntu@ubuntu: ~$ sudo pon dsl-provider
```

After these steps it is advised to restart your computer.

After this do not forget to enter again all the commands that should be typed in at each boot time:

- start PPPv6 dialer
- Routing table settings
- request /56 DHCPv6 address
- start Router Advertisement Daemon

### Automation of commands

If you do not want to make gateway settings upon each computer start, the following steps should be completed.

Please, type in the following command:

```
ubuntu@ubuntu: ~$ sudo gedit /etc/init.d/script3.sh
```

This command creates a script called script3.sh, into which you have to copy the following commands:

```
#!/bin/bash
echo -e "\n A Létező ppp kapcsolatok bontása!\n"
  poff -a
  sleep 3

echo -e "\n Az IPv6-os ppp kapcsolat létrehozása\n"
  pon dsl-provider
  sleep 8
  ifconfig ppp0

echo -e "\n A routing tábla és egyéb szükséges paraméterek beállítása!\n"
  route add -A inet6 default dev ppp0
  sysctl -w net.ipv6.conf.all.forwarding=1
  sleep 2

echo -e "\n Ha a dhcp6c fut, újraindítjuk azt!\n"
  kill `cat /var/run/dhcp6c.pid`
  dhcp6c ppp0
  sleep 2
  ifconfig eth0
  sleep 2

echo -e "\n A Router Advertisement indítása!\n"
  radvd

echo "A script lefutott"
```

You have to give the right authorization for the file to run:

```
ubuntu@ubuntu: ~$ chmod +x script3.sh
```

If later you want to start the script only manually, then at each boot time, please type in the following line:

```
ubuntu@ubuntu: ~$ sudo ./etc/init.d/script3.sh
```

If you want to automatically run the command at system boot time, please, enter the following command:

```
ubuntu@ubuntu: ~$ sudo update-rc.d script3.sh defaults 91
```

This function can be switched off at any time, if you do not need it:

```
ubuntu@ubuntu: ~$ sudo update-rc.d -f script3.sh remove
```

You can check the settings with the following command:

```
ubuntu@ubuntu: ~$ ls -l /etc/rc?.d/*script3.sh
```