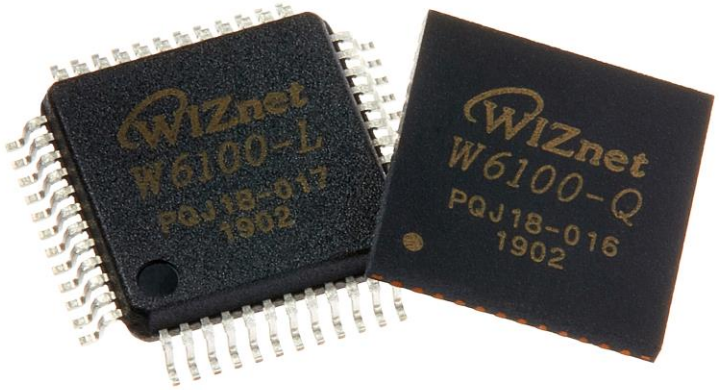
SOCKET-less Command Application Note

Version 1.0.0



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1 Introduction

W6100 transmits specific packet through SOCKET-less Commands without separate SOCKET OPEN.

The result of the packet transmission is known through the SLIR register, and confirms information about the reply packet received through specific registers. Also, SOCKET-less Commands can not be performed concurrently until the previous command completes execution.

2 SOCKET-less Commands

SOCKET-less Commands should be executed after setting related information through specific registers. The types of commands are as follows.

- ARP4 Command
- PING4 Command
- ARP6 Command
- PING6 Command
- NS Command
- RS Command
- UNA Command

Commands except for UNA Command transmit a request in the request-reply structure and then wait for a reply. If a Reply Packet is not received within the time set by SLRCR and SLRTR, TOUT Interrupt occurs. When a Reply Packet is received, the corresponding packet interrupt is occurred.

Unsolicited NA Command does not wait for reply. If message transmission is completed, TOUT Interrupt occurs.

Also, since SOCKET-less Commands can not be executed simultaneously, if you want to execute several commands, check the interrupt for the previous command and execute the next command.

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2.1 ARP(Address Resolution Protocol)

ARP is a message for getting the MAC address of the other party in the request-reply structure. ARP Request Message to request the MAC address of the corresponding IP address and get the MAC address through the ARP Response Message. The ARP request message is the same as the Neighbor Solicitation message in IPv6, the ARP reply message is the same as the Neighbor Advertisement message in IPv6.

When the W6100 is set to Connect command in TCP communication or Send Command in IPRAW or UDP communication, ARP is executed and MAC address is got and the packet is transmitted to the corresponding address. When the Socket is set to the Destination Hardware address mode, the packet is transmitted to the MAC address set by the user in the Sn_DHAR without ARP process. In addition, if you want to send ARP separately, you can send it through SOCKET-less command and check MAC address through SLDHAR register.

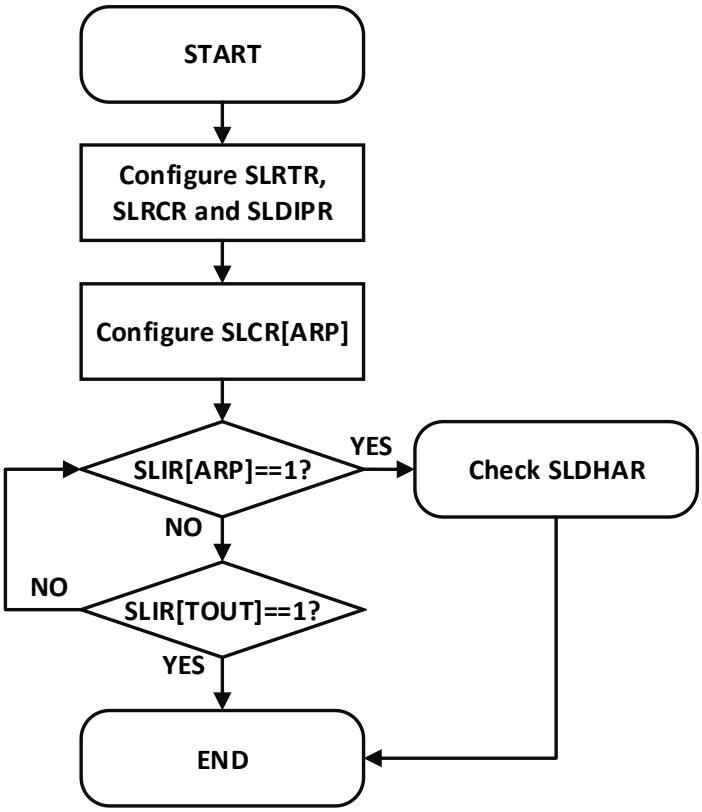


Figure 1 ARP Command Operation Flow

2.1.1 Example code

Send ARP Request through SOCKET-less Command using ctlnetservice() in Io6Library. The transmission method of IPv4 and IPv6 is the same and distinguished by the length of the address. The return value of ctlnetservice() indicates whether the ARP response is received.

IPv4

```
wiz_ARP arp4_info={ .destinfo={.ip={192,168,0,232}, .len=4}};

if(ctlnetservice(CNS_ARP, &arp4_info) == 0)
{
        printf("DHAR=%.2x:%.2x:%.2x:%.2x:%.2x:%.2x₩r₩n",
        arp4_info.dha[0],arp4_info.dha[1],arp4_info.dha[2],
        arp4_info.dha[3],arp4_info.dha[4],arp4_info.dha[5]);
}
else printf("No Target ₩r₩n");
```

IPv6

```
wiz_ARP arp6_info={ .destinfo={.ip={0xfe,0x80, 0x00,0x00,
                                    0x00,0x00, 0x00,0x00,
                                    0x31,0x71,0x98,0x05,
                                    0x70,0x24,0x4b,0xb1}, .len=16}};

if(ctlnetservice(CNS_ARP, &arp6_info) == 0)
{
       printf("DHAR=%.2x:%.2x:%.2x:%.2x:%.2x:%.2x₩r₩n",
       arp6_info.dha[0],arp6_info.dha[1],arp6_info.dha[2],
       arp6_info.dha[3],arp6_info.dha[4],arp6_info.dha[5]);
}
else printf("No Target ₩r₩n");
```

2.1.2 Success Case

If the return value of ctlnetservice() is 0, the ARP response is received and the MAC address is stored in dha.

No.	Time	Source	Destination	Protocol	Length	Info
659	43.521…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.232? Tell 192.168.0.107
660	43.521…	AsustekC_2a:c2:e3	Wiznet_57:57:61	ARP	42	192.168.0.232 is at 08:62:66:2a:c2:e3

2.1.3 Fail Case

If the return value of ctlnetservice () is -1, Timeout is occurred and the ARP response is not received.

No.	Time	Source	Destination	Protocol	Length	Info
192	14.039…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.9? Tell 192.168.0.107

The initial value of Retransmission Count of Socket Less Command is 0, so retransmission does not occur. If retransmission should be generated, retransmission count value should be set through ctlnetwork(). For example, sl_retry_count is set to 3, and a total of 4 ARP requests are transmitted.

```
wiz_NetTimeout
timeout={.s_retry_cnt=8, .s_time_100us=2000, .sl_retry_cnt=3, .sl_time_100us=1000};
ctlnetwork(CN_SET_TIMEOUT, &timeout);
```

No.	Time	Source	Destination	Protocol	Length	Info
815	20.479…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.9? Tell 192.168.0.107
816	20.580…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.9? Tell 192.168.0.107
818	20.680…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.9? Tell 192.168.0.107
825	20.781…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.9? Tell 192.168.0.107

2.2 PING

PING is a message for confirming the network status of the other party in the request-reply structure. After transmitting the PING Request Message, it waits for a response and checks the network status of the other party through Response Message.

If you want to transmit PING in W6100, you can send it through SOCKET-less command. You can check the MAC address obtained through ARP process, which was performed automatically before transmitting PING request, through SLDHAR register.

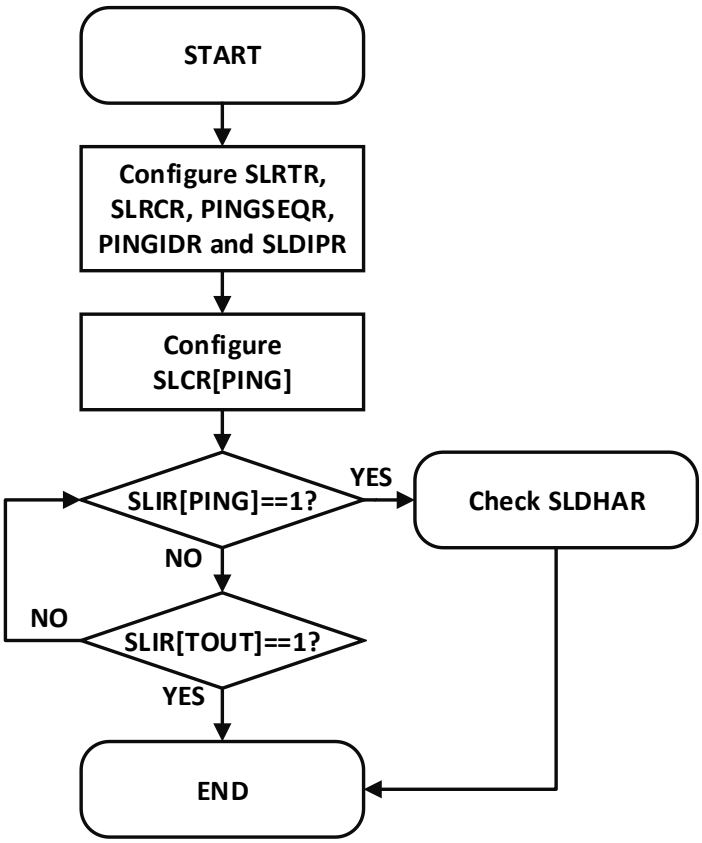


Figure 2 PING Command Operation Flow

2.2.1 Example code

Send PING Request through SOCKET-less Command using ctlnetservice() in Io6Library. The transmission method of IPv4 and IPv6 is the same and distinguished by the length of the address. The return value of ctlnetservice() indicates whether the PING response is received.

IPv4
wiz_PING ping4_info={ .id=0x1234, .seq=0x4321, .destinfo={.ip={192,168,0,232}, .len=4} if(ctlnetservice(CNS_PING, &ping4_info) == 0) printf("Receive a PING4 Response₩r₩n"); else printf("No Response ₩r₩n");
IPv6
wiz_PING ping6_info={ .id=0x1234, .seq=0x4321, .destinfo={.ip={0xfe,0x80, 0x00,0x00, 0x00,0x00, 0x00,0x00, 0x31,0x71,0x98,0x05, 0x70,0x24,0x4b,0xb1}, .len=16} if(ctlnetservice(CNS_PING, &ping6_info) == 0) printf("Receive a PING6 Response₩r₩n"); else printf("No Response ₩r₩n");

2.2.2 Success Case

If the return value of ctlnetservice() is 0, the MAC address is stored in dha after receiving the ping response.

ID and Sequence values of the Ping Request Packet are applied to id and seq set in ping4_info.

No.	Time	Source	Destination	Protocol	Length	Info
55	3.9607…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.232? Tell 192.168.0.107
56	3.9607…	AsustekC_2a:c2:e3	Wiznet_57:57:61	ARP	42	192.168.0.232 is at 08:62:66:2a:c2:e3
57	3.9608…	192.168.0.107	192.168.0.232	ICMP	74	Echo (ping) request id=0x1234, seq=17185/8515,
58	3.9609…	192.168.0.232	192.168.0.107	ICMP	74	Echo (ping) reply id=0x1234, seq=17185/8515,

2.2.3 Fail Case

If the return value of ctlnetservice() is -1, Timeout is occurred and there are two cases.

In the first case, the PING request could not be transmitted because the ARP response was not received before the PING request was transmitted.

No.	Time	Source	Destination	Protocol	Length	Info
32	2.0309…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.9? Tell 192.168.0.107

In the second case, the ARP response was received but the response to the PING request was not obtained.

No.	Time	Source	Destination	Protocol	Length	Info
32	2.0309…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.9? Tell 192.168.0.107
10…	41.108…	Wiznet_57:57:61	Broadcast	ARP	60	Who has 192.168.0.232? Tell 192.168.0.107
10…	41.108…	192.168.0.107	192.168.0.232	ICMP	74	Echo (ping) request id=0x1234, seq=17185/8515,

If you want to increase the retransmission count to generate a retransmission, refer to 2.1.3.

2.3 NS(Neighborhood Solicitationn)

In IPv6, Host IP Address is generated by stateful auto-configuration method and stateless auto-configuration method. Stateless auto-configuration is a method in which a host generates its own address. In the case of LLA (Link Local Address), it can be generated by NS Command, and in case of GUA (Global Unicast Address), RS Command.

The LLA generates the prefix information by attaching the interface ID information to the prefix information, and performs the DAD (Duplicate Address Detection) process to use the generated LLA. DAD process can detect duplicate address by receiving NA packet after transmitting NS packet.

10 bits	54 bits	64 bits
1111 1110 10	0	Interface ID

Table 1 Link-Local Address Format

To execute DAD process, Set the LLA created in SLDIPR and transmit NS Packet via NS Command. If NA Packet is not received for a certain period of time, the LLA can be used as uniquely verified. However, if the NA Packet is received in reply to the NS Packet, the LLA is already in use and can not be used.

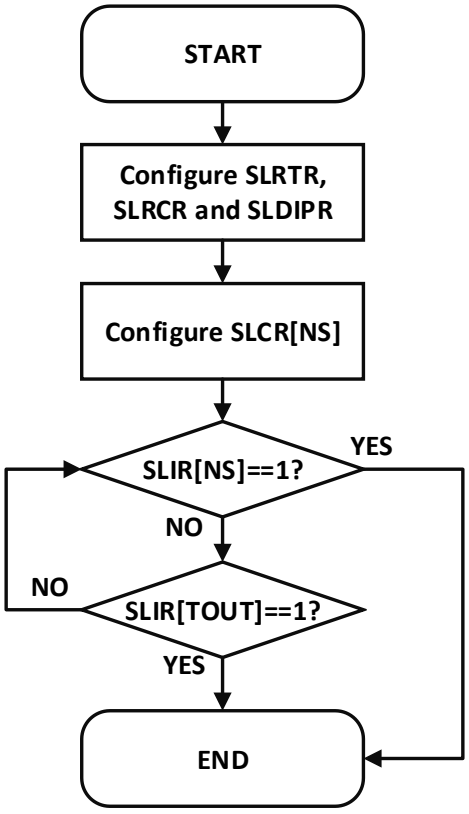


Figure 3 NS Command Operation Flow

2.3.1 Example Code

Io6Library에 있는 ctlnetservice()를 이용하여 SOCKET-less Command를 통해 NS Packet을 전송하여 DAD를 수행한다. 매개변수로 사용하고자 하는 주소를 설정한다. ctlnetservice()의 return 값에 DAD 결과를 알 수 있다.

```
uint8_t dad_info[16]={0xfe,0x80, 0x00,0x00,
        0x00,0x00, 0x00,0x00,
        0x02,0x08, 0xdc,0xff,
        0xfe,0x57, 0x57,0x61
        };
if(ctlnetservice(CNS_DAD, dad_info) == 0)
        printf("No Response(=Valid)₩r₩n");
else printf("No Valid ₩r₩n");
```

2.3.2 Success Case

If the return value of ctlnetservice() is 0, it means that NA for NS is not received. Since there is no device using IPv6 address, it can be used. If you want to increase the Retransmission Count to generate retransmissions, refer 2.1.3.

No.	Time	Source	Destination	Protocol	Length	Info
473	5.2732…	::	ff02::1:ff57:5761	ICMPv6	78	Neighbor Solicitation for fe80::208:dcff:fe57:5761

2.3.3 Fail Case

If the return value of ctlnetservice() is -1, it means that NA has been received for NS. Since there is a device using the IPv6 address, the corresponding address is not available.

No.	Time	Source	Destination	Protocol	Length	Info
12…	15.080…	::	ff02::1:ff24:4bb1	ICMPv6	78	Neighbor Solicitation for fe80::3171:9805:7024:4bb1
12…	15.080…	fe80::3171:9805:7…	ff02::1	ICMPv6	86	Neighbor Advertisement fe80::3171:9805:7024:4bb1 (ov

2.4 RS(Router Solicitation)

As mentioned in NS, the Host IP address in IPv6 generates a host gas address in a stateless auto-configuration manner, and in the case of GUA (global unicast address), it is generated through RS command.

Unlike LLA, Prefix information is not fixed for GUA. Therefore, in case of LLA, NS packet is transmitted to perform DAD, but in case of GUA, RS packet is transmitted to the router in order to get Prefix information.

To get Prefix information, set the IP address of Router in SLDIPR register, and then transmit RS packet through RS Command. If RA packets are received in reply to RS Packet, generate GUA using Prefix information and Interface ID obtained from RA Packet. Prefix Length, Valid Life Time, Preferred Life Time, and Prefix Address can be checked through PLR, PFR, VLTR, PLTR, and PAR, respectively.

48bits	16bits	64 bits
Prefix	Subnet ID	Interface ID

Table 2 Global Unicast Address Format

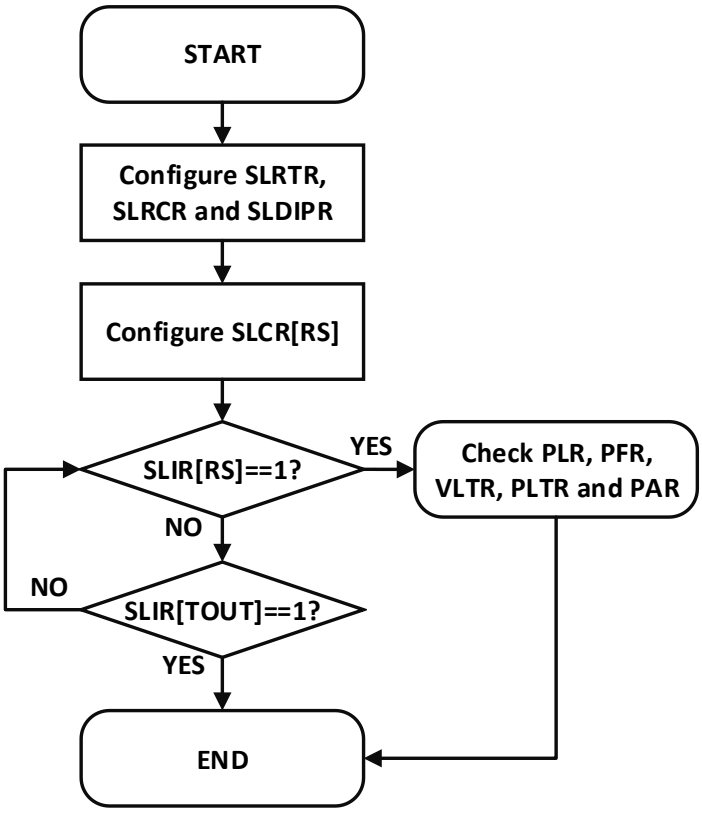


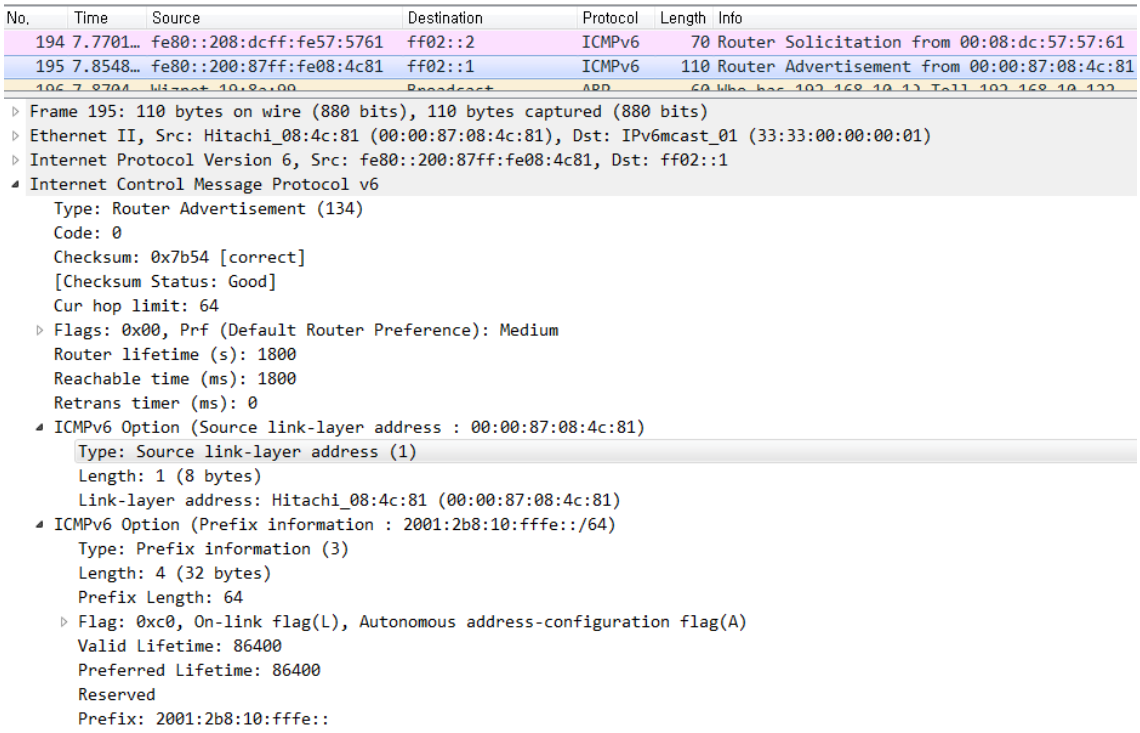
Figure 4 RS Command Operation Flow

2.4.1 Example Code

```
wiz_Prefix info;
if(ctlnetservice(CNS_SLAAC, &info) == 0)
{
    printf("Prefix Length = %d\r\n", info.len);
    printf("Prefix Flag = %d\r\n", info.flag);
    printf("Prefix Valid Life Time = %d\r\n", info.valid_lifetime);
    printf("Prefix Preferred Life Time : %d\r\n", info.preferred_lifetime);
    printf("PrefixAddress=%.2x%.2x:%.2x%.2x:%.2x%.2x:%.2x%.2x:%.2x%.2x:%.2x%.2x:%.2x%.2x:
%.2x%.2x\r\n", info.prefix[0], info.prefix[1], info.prefix[2], info.prefix[3], info.prefix[4],
info.prefix[5], info.prefix[6], info.prefix[7], info.prefix[8], info.prefix[9], info.prefix[10],
info.prefix[11], info.prefix[12], info.prefix[13], info.prefix[14], info.prefix[15]) ;
}
else printf("Not Valid \r\n");
```

2.4.2 Success Case

If the return value of ctlnetservice() is 0, it is the reception of RA for RS, and prefix length, prefix flag, prefix valid life time, prefix preferred life time, and prefix address are stored. However, this value is guaranteed only when the Option Field of the RS is the Source link-layer address, and the second is the Prefix information, as shown below. If such an environment is not guaranteed, use the IPRAW6 SOCKET to receive the values.



2.4.3 Fail Case

If the return value of ctlnetservice () is -1, Timeout is processed and RA is not received for RS. If you want to increase the Retransmission Count to generate retransmissions, refer to 2.1.3.

No.	Time	Source	Destination	Protocol	Length	Info
286	3.8233…	fe80::208:dcff:fe57:5761	ff02::2	ICMPv6	70	Router Solicitation from 00:08:dc:57:57:61

2.5 UNA (Unsolicited Neighbor Advertisement)

An NA message is generally used as a response to an NS message, but it is used to notify of a change even if it is not received. Unlike other commands, the TOUT interrupt is generated when the message transmission is completed.

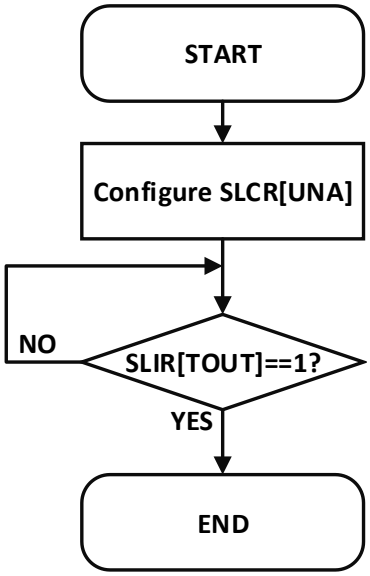


Figure 5 UNA Command Operation Flow

2.5.1 Example Code

```
if(ctlnetservice(CNS_UNSOL_NA, 0 ) == 0)
    printf("Transmit UNA Packet\r\n");
else
    printf("Transmit Failed\r\n");
```

2.5.2 Success Case

If the return value of ctlnetservice () is 0, it means that NA is transmitted.

No.	Time	Source	Destination	Protocol	Length	Info
245	3.4244…	fe80::208:dcff:fe57:5761	ff02::1	ICMPv6	86	Neighbor Advertisement fe80::208:dcff:fe57:5761

3 Document History Information

Version	Date	Descriptions
Ver. 1.0.0	Feb, 2019	Release

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