

# **DNSNA: DNS Name Autoconfiguration for Internet of Things Devices**

**draft-jeong-homenet-device-name-autoconf-03**



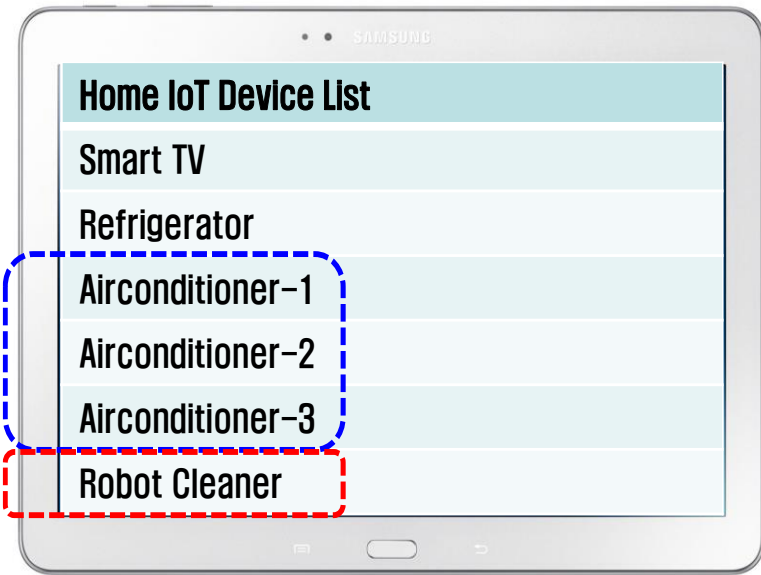
**IETF 93, Prague, Czech  
July 20, 2015**

**Jaehoon (**Paul**) Jeong and Jung-Soo Park**

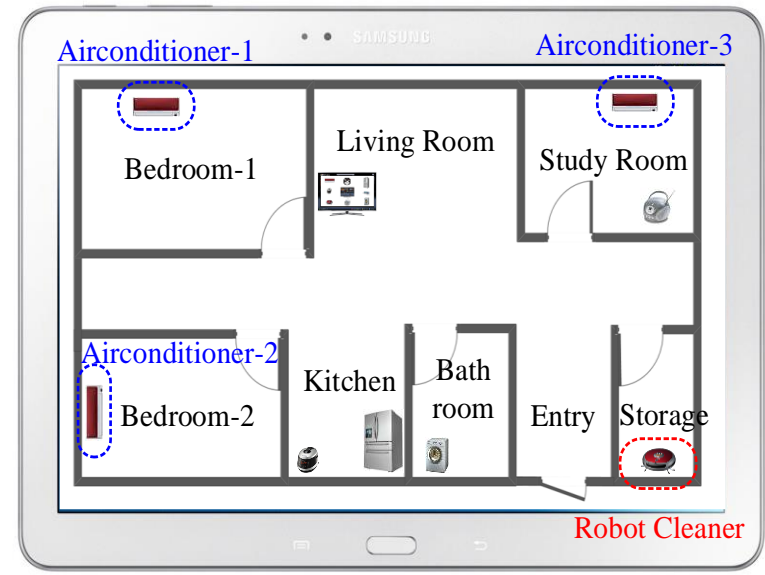
**Sungkyunkwan University & ETRI**

# Motivation: Location-Based Service

## Text-based Display of Devices by AllSeen Alliance



## Image-based Display of Devices by Indoor Localization



### ❖ Goal

- **DNS Name Autoconfiguration** for Device DNS Name
  - Without the intervention of a network administrator or home user.

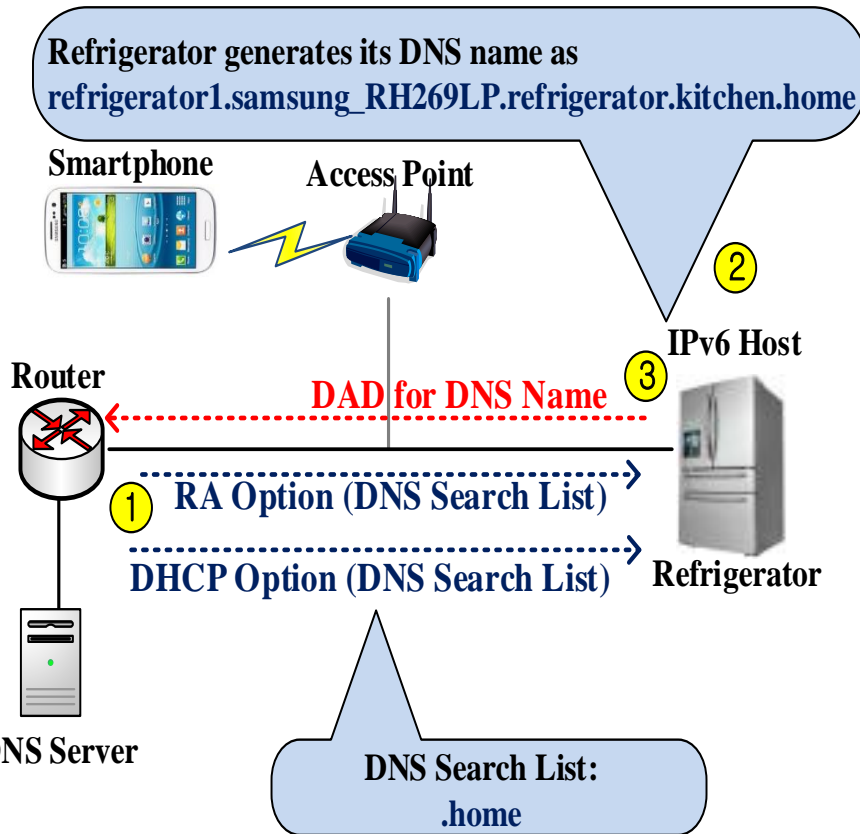
### ❖ Applicability Domains

- Home, Office, Smart Grid, Road Network, Mall (e.g., Walmart and Best Buy), and Factory (e.g., Samsung and Hyundai)

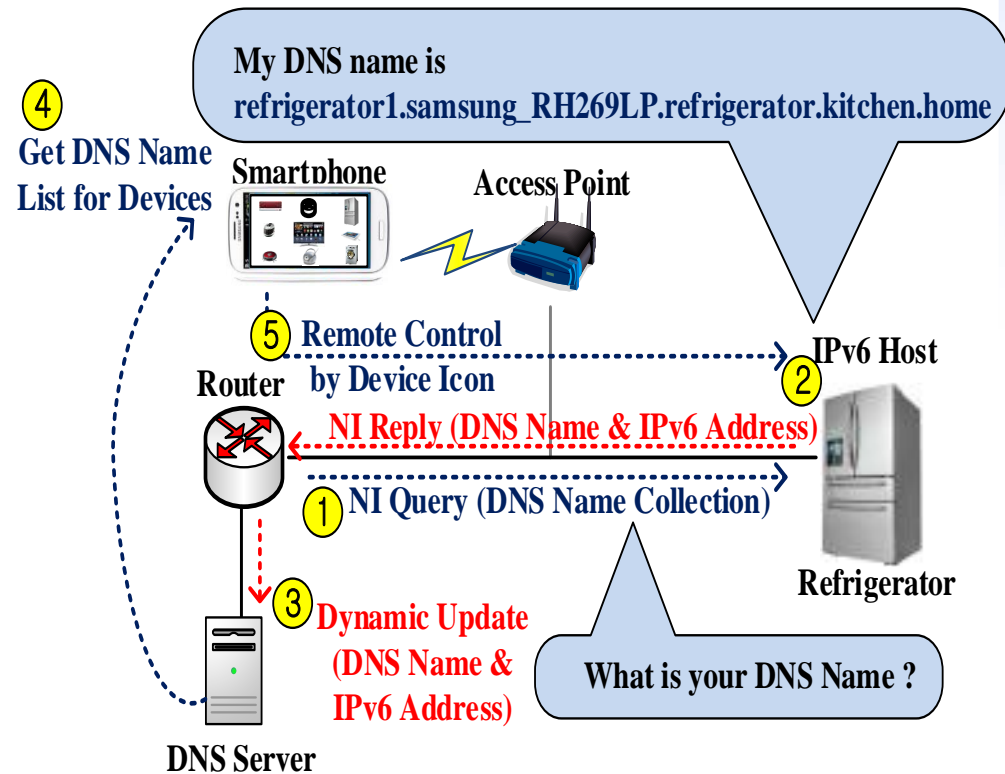
# Protocol: DNS Name Autoconfiguration

## ❖ Generation and Registration of Device's DNS Name

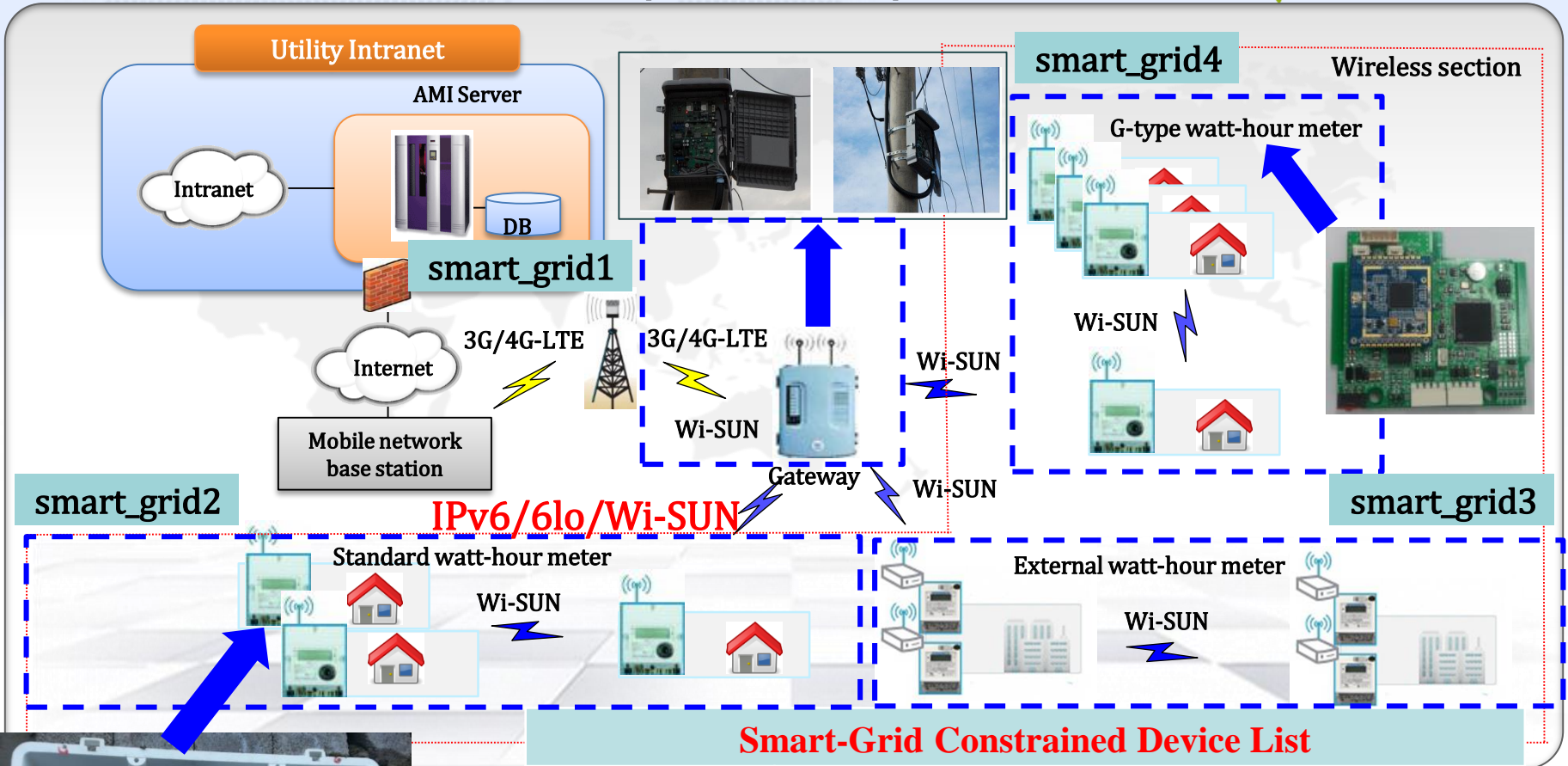
### Generation



### Registration



# Applicability Domain: Smart Grid in Korea Electric Power Corporation (KEPCO) for Pilot Service



## Smart-Grid Constrained Device List

Gateway	<i>gateway.smart_grid1.grid</i>
Standard_meter1	<i>standard_meter1.smart_grid2.grid</i>
Standard_meter2	<i>standard_meter2.smart_grid2.grid</i>
External_meter1	<i>external_meter1.smart_grid3.grid</i>
External_meter2	<i>external_meter2.smart_grid3.grid</i>
G_type_meter1	<i>g_type_meter1.smart_grid4.grid</i>



# Appendix Slides



# Demonstration Devices

## ❖ Gateway: Jubix RU-DLB200 Rev2



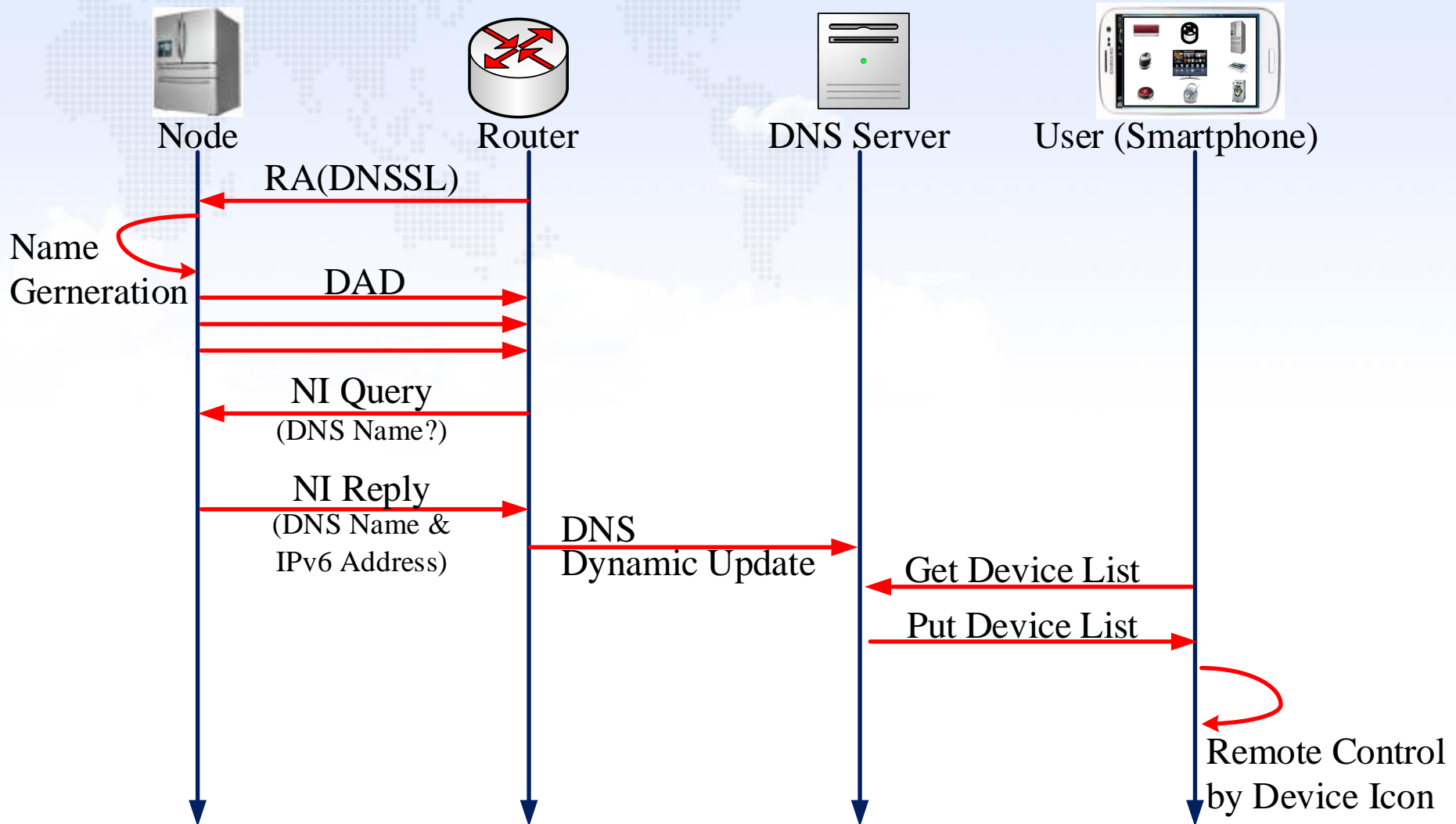
## ❖ Meter (Constrained Device):

Jubix AMI G-Type Modem RevB (JB-AWM-G)

Jubix AMI E-Type Modem RevB (JB-AWM-E)



# Time Sequence Diagram for DNSNA



# DNSNA vs. mDNS (RFC6762)

<b>Approaches</b>	<b>DNSNA</b>	<b>mDNS</b>
<b>Packet Forwarding</b>	Unicasting	Multicasting
<b>Authoritative DNS Server</b>	Yes	No (host itself is server)
<b>Naming Scope</b>	Global or Local	Local
<b>Target Networks</b>	Small or Large	Small
<b>Socket</b>	RAW/IPv6	UDP/IPv6
<b>Implementation</b>	Kernel Space	User Space
<b>Implementation Overhead</b>	A little extension of ND	mDNS application required
<b>Code Size</b>	Hundreds lines	Thousands lines
<b>Target Devices</b>	Constrained Devices (i.e., IoT Devices)	Apple® Products
<b>Resource Usage (CPU, Memory, Energy)</b>	Small	Big



# DNSNA Configuration

## ❖ Features

Parameter	Gateway	Meter
OS	Linux	FreeRTOS
CPU	ARM Cortex-A5	ARM Cortex-M4
RAM	DDR2 256Mbyte	64K-byte embedded SRAM
Flash Memory	256Mbyte	256/512 Kbytes

## ❖ The Configuration of Router Advertisement Daemon (radvd)

```
Interface wisun0
```

```
{
```

```
    AdvSendAdvert on;  
    MinRtrAdvInterval 600;  
    MaxRtrAdvInterval 1800;
```

```
    Prefix 2001:2c8:ee:100::/64
```

```
    {
```

```
        AdvOnLink on;  
        AdvAutonomous on;  
        AdvRouterAddr off;
```

```
    };
```

```
    RDNSS 2001:2c8::1
```

```
    {
```

```
        AdvRDNSSLifetime 3600;
```

```
    };
```

```
    DNSSL sector1.grid
```

```
    {
```

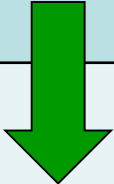
```
        AdvDNSSLifetime 3600;
```

```
    };
```

```
};
```

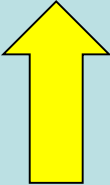
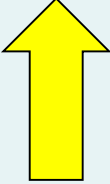
# Demonstration of DNSNA (1/4)

## ❖ Router Advertisement with DNSSL (One Gateway → Two Meters)

<p><b>Gateway</b></p> 	<pre># tcpdump_dlb -i wisun0 icmp6 tcpdump_dlb: WARNING: wisun0: no IPv4 address assigned tcpdump_dlb: verbose output suppressed, use -v or -vv for full protocol decode listening on wisun0, link-type EN10MB (Ethernet), capture size 65535 bytes 03:16:23.670986 IP6 fe80::e05b:85ff:fe74:cc02 &gt; ff02::2: ICMP6, router solicitation, length 16 03:16:23.674002 IP6 fe80::e25b:85ff:fe74:0 &gt; ff02::1: ICMP6, router advertisement, length 80 03:16:24.685071 IP6 :: &gt; ff02::1:ffb5:51ef: ICMP6, neighbor solicitation, who has fe80::107d:97f9:43ba:51ef, length 24 03:16:24.935606 IP6 :: &gt; ff02::1:ff25:ebc5: ICMP6, neighbor solicitation, who has fe80::5350:bced:5825:ebc5, length 24</pre>
<p><b>Meter 1</b></p>	<pre>[ICMP] Recv RA : L=80 Router Addr : fe 80 00 00 00 00 00 00 e2 5b 85 ff fe 74 00 00 option dnssl L=16, 07 73 65 63 74 65 72 31 04 67 72 69 64 00 00 00 DNS Search List : L=12, secter1.grid Make DNS Name AutoConf : L=53, gtype_meter_cc14.jubix_wagmcc.powermeter.secter1.grid Wire Domain Name : L=56 [16] gtype_meter_cc14 [12] jubix_wagmcc [10] powermeter [ 7] secter1 [ 4] grid</pre>
<p><b>Meter 2</b></p>	<pre>[ICMP] Recv RA : L=80 Router Addr : fe 80 00 00 00 00 00 00 e2 5b 85 ff fe 74 00 00 option dnssl L=16, 07 73 65 63 74 65 72 31 04 67 72 69 64 00 00 00 DNS Search List : L=12, secter1.grid Make DNS Name AutoConf : L=53, etype_meter_cc02.jubix_waemcc.powermeter.secter1.grid Wire Domain Name : L=56 [16] etype_meter_cc02 [12] jubix_waemcc [10] powermeter [ 7] secter1 [ 4] grid</pre>


# Demonstration of DNSNA (2/4)

## ❖ Duplicate Address Detection (DAD) for DNS Names

 <p>Meter 1</p>	<pre>Make DNS Name MD5 Addr : fe 80 00 00 00 00 00 00 53 50 bc ed 58 25 eb c5 Check DAD for DNS Name [NDP] Send NS : L=24       option target L=16, fe 80 00 00 00 00 00 00 53 50 bc ed 58 25 eb c5 [6LoW] tx next hop is broadcast [CC14-&gt;FFFF] Tx 6LoWPAN : L=80 [HMI] Tx MCPS-DATA.Reg : P=0101, PL=120 [HMI] Rx MCPS-DATA.Cnf : P=0102, PL=12  Check DAD for DNS Name [NDP] Send NS : L=24       option target L=16, fe 80 00 00 00 00 00 00 53 50 bc ed 58 25 eb c5 [6LoW] tx next hop is broadcast [CC14-&gt;FFFF] Tx 6LoWPAN : L=80 [HMI] Tx MCPS-DATA.Reg : P=0101, PL=120 [HMI] Rx MCPS-DATA.Cnf : P=0102, PL=12  Check DAD for DNS Name [NDP] Send NS : L=24       option target L=16, fe 80 00 00 00 00 00 00 53 50 bc ed 58 25 eb c5 [6LoW] tx next hop is broadcast [CC14-&gt;FFFF] Tx 6LoWPAN : L=80 [HMI] Tx MCPS-DATA.Reg : P=0101, PL=120 [HMI] Rx MCPS-DATA.Cnf : P=0102, PL=12</pre>
 <p>Meter 2</p>	<pre>Make DNS Name MD5 Addr : fe 80 00 00 00 00 00 00 10 7d 97 f9 43 ba 51 ef Check DAD for DNS Name [NDP] Send NS : L=24       option target L=16, fe 80 00 00 00 00 00 00 10 7d 97 f9 43 ba 51 ef [6LoW] tx next hop is broadcast [CC02-&gt;FFFF] Tx 6LoWPAN : L=80 [HMI] Tx MCPS-DATA.Reg : P=0101, PL=120 [HMI] Rx MCPS-DATA.Cnf : P=0102, PL=12  Check DAD for DNS Name [NDP] Send NS : L=24       option target L=16, fe 80 00 00 00 00 00 00 10 7d 97 f9 43 ba 51 ef [6LoW] tx next hop is broadcast [CC02-&gt;FFFF] Tx 6LoWPAN : L=80 [HMI] Tx MCPS-DATA.Reg : P=0101, PL=120 [HMI] Rx MCPS-DATA.Cnf : P=0102, PL=12  Check DAD for DNS Name [NDP] Send NS : L=24       option target L=16, fe 80 00 00 00 00 00 00 10 7d 97 f9 43 ba 51 ef [6LoW] tx next hop is broadcast [CC02-&gt;FFFF] Tx 6LoWPAN : L=80 [HMI] Tx MCPS-DATA.Reg : P=0101, PL=120 [HMI] Rx MCPS-DATA.Cnf : P=0102, PL=12</pre>

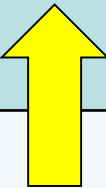
# Demonstration of DNSNA (3/4)

## ❖ Node Information Query for DNS Name Collection

<p style="text-align: center; font-size: 2em;"><b>Gateway</b></p> 	<pre> Timestamp: 2015/07/16 03:31:20 ----- * <u>Send NI Query</u>   Len=32   To   ff02::1 ----- * Type      : 139, Node Information Query * Code      : 0, Query Subject is IPv6 Address * Checksum  : 0x0000 * Qtype     : 2, Node Name * Flags     : 0x0000 * Nonce    : 0x3483698389323283 * IPv6 Addr : ff02::1 ----- 8b 00 00 00 00 02 00 00 34 83 69 83 89 32 32 83 ff 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01           </pre>
<p style="text-align: center; font-size: 2em;"><b>Meter 1</b></p>	<pre> <u>[ICMP] Recv NI Query : L=32</u> Code 0...ipv6 Qtype 2...node name Data : L=16, ff 02 00 00 00 00 00 00 00 00 00 00 00 00 00 01           </pre>
<p style="text-align: center; font-size: 2em;"><b>Meter 2</b></p>	<pre> <u>[ICMP] Recv NI Query : L=32</u> Code 0...ipv6 Qtype 2...node name Data : L=16, ff 02 00 00 00 00 00 00 00 00 00 00 00 00 00 01           </pre>

# Demonstration of DNSNA (4/4)

## ❖ Node Information Reply for DNS Name Collection

<p style="text-align: center;"><b>Gateway</b></p> 	<pre>* Recv NI Reply  Len=76   From fe80::e05b:85ff:fe74:cc02 ----- * Type      : 140, Node Information Reply * Code      : 0, Reply is Success * Checksum  : 0x7a19 * Qtype     : 2, Node Name * Flags     : 0x0000 * Nonce     : 0x3483698389323283 * TTL       : 0 * Node Name : etype_meter_cc02.jubix_waemcc.powermeter.secter1.grid -----</pre>
<p style="text-align: center;"><b>Meter 1</b></p>	<pre>* Recv NI Reply  Len=76   From fe80::e05b:85ff:fe74:cc14 ----- * Type      : 140, Node Information Reply * Code      : 0, Reply is Success * Checksum  : 0x7604 * Qtype     : 2, Node Name * Flags     : 0x0000 * Nonce     : 0x3483698389323283 * TTL       : 0 * Node Name : gtype_meter_cc14.jubix_wagmcc.powermeter.secter1.grid -----</pre>
<p style="text-align: center;"><b>Meter 2</b></p>	<pre>[ICMP] Send NI Reply : L=76 Code 0...success Qtype 2...node name Data : L=56 [16] etype_meter_cc02 [12] jubix_waemcc [10] powermeter [ 7] secter1 [ 4] grid</pre>