Form Data

Revision History

Document Approval

Icron Technologies Corp.



SwitchableUSB™: Device Configuration Network Protocol

|  |  |
| --- | --- |
| Document # |  |
| Version |  |
| Date Saved | 6/23/2016 12:31 PM |
| Date Archived |  |
| Author |  |

Table of Contents

1 Overview 3

2 General Information 4

2.1 Generic Packet Structure 4

2.2 Network Broadcast Notes 4

3 Supported Messages 5

3.1 Request Device Information 5

3.2 Reply Device Information 5

3.3 Ping 6

3.4 Acknowledge 6

3.5 Request Extended Device Information 7

3.6 Reply Extended Device Information 7

3.7 Pair To Device 7

3.8 Remove Device Pairing 8

3.9 Request Device Topology 8

3.10 Reply Device Topology 9

3.11 Use DHCP 9

3.12 Use Static IP 10

3.13 Negative Acknowledge 11

3.14 Use Filtering Strategy 11

3.15 LED Locator On 12

3.16 Led Locator Off 12

3.17 Reset Device 12

3.18 Request Configuration Response Data 12

3.19 Reply Configuration Response Data 13

4 Appendix A 15

4.1 Abbreviations 15

4.2 Glossary 15

4.3 References 15

4.4 Revision History 15

4.5 Document Approval 15

# Overview

Icron Technologies' "SwitchableUSB™: Device Configuration Network Protocol" provides the ability to discover and configure Icron ExtremeUSB® extenders on a local ethernet network. The protocol works on top of UDP, so it should be possible to write a configuration client for almost any platform. The Icron devices will listen on UDP port 6137 for incoming messages and replies will be sent back to the port that the request originated from. The USB extenders will include a DHCP client that will enable them to obtain an IP address from a DHCP server on the network. The devices may alternatively be assigned a static network configuration using UDP broadcast packets in the form of a Use Static IP message described later in this document.



Figure - Icron USB extenders on a local network

# General Information

## Generic Packet Structure

All packets contain the following:

|  |  |
| --- | --- |
| Magic Number | A value (0x2F03F4A2) which gives some confidence that the data which follows is an ICRON configuration message. |
| Message ID | When the client sends a request, it chooses any value to insert in this field. The device responding to the request will set this field in the reply to the same value it received in the request. |
| Protocol Version | An integer from 0-255. All devices will support protocol 0 and one other protocol version. The Reply Device Information message will inform a client which version of the protocol it must speak in order to communicate with the device. |
| Command | An integer from 0-255. This is the identifier of the command. The combination of the protocol version and the command identify a unique message type. In other words, command 5 in protocol 1 is likely different from command 5 in protocol 3. |

* All multi-byte fields are packed as big endian.
* Messages are at least 10 bytes and at most 136 bytes in length.
* Any string fields should be encoded using UTF-8.

## Network Broadcast Notes

Further information about Network Broadcast Notes can be found at the [references section](#_References).

### Subnet Broadcast

To broadcast a packet to a subnet you only have to use the broadcast IP of the subnet. For example to broadcast to a network configured as an IP range of 192.168.5.xxx, and a netmask of 255.255.255.0, the IP 192.168.5.255 is the broadcast IP address. For example to broadcast to a network configured as an IP range of 10.xxx.xxx.xxx, and a netmask of 255.0.0.0, the IP 10.255.255.255 is the broadcast IP address.

Routers will drop broadcast IP packets, destined for an address outside of the source address device’s network; which means that any broadcast packet must originate on the same network as the target devices.

### All Local Subnet Broadcast

By broadcasting to the IP address 255.255.255.255 a broadcast packet can be sent out, without previously knowing what the local network is. Microsoft Windows will however only send the packet out the first configured network interface, so on a computer with multiple interfaces, each interface should sent a broadcast network packet separately.

### Mismatched Network Configuration

When broadcasting to a subnet using the network broadcast address (for example 192.168.5.255), and the device is configured for a different network (for example IP=10.0.9.23, netmask=255.0.0.0), then the device will not respond to the broadcast as it will not recognize the IP address as a valid broadcast.

This shouldn’t happen with a proper DHCP server allocated addresses out of the same pool for the network. It could potentially happen when assigning static IP addresses, and moving units between networks. If this does happen the unit will need to be reset to DHCP by the push button, as described in the user’s guide, and then the static IP address can be assigned to the unit.

# Supported Messages

## Request Device Information

This message is sent from the client to a device in order to solicit a Reply Device Information message. This message can be sent in a broadcast UDP message in order to discover all of the configurable Icron USB extenders on the local network.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 0 | Command = 0 |

+-----------------------------------------+-----------------------------------------+

## Reply Device Information

This message is sent from a device to a client in response to a Request Device Information message. This message is also broadcast from a device on startup if Network Mode = 1 (static) or as soon as an IP has been obtained or after a timeout (length TBD) if an IP cannot be obtained in DHCP mode.

### Field Descriptions

|  |  |
| --- | --- |
| MAC Address | The device's MAC address. |
| IP Address | The device's current IP address. |
| Network Acquisition Mode | 0=DHCP, 1=Static |
| Supported Protocol Version | All devices must support protocol 0 and one other protocol number. This value specifies which protocol version that is. |
| Vendor | A 32 byte NUL terminated string containing the device's vendor name. |
| Product | A 32 byte NUL terminated string containing the device's product name. |
| Revision | A 12 byte NUL terminated string containing the device's revision number. |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 0 | Command = 1 |

+-----------------------------------------+-----------------------------------------+

10 | MAC Address |

+ +

12 | |

+ +

14 | |

+-----------------------------------------+-----------------------------------------+

16 | IP Address |

+ +

18 | |

+-----------------------------------------+-----------------------------------------+

20 | Network Acquisition Mode | Supported Protocol Version |

+-----------------------------------------+-----------------------------------------+

22 | Vendor |

+ +

. . .

. . .

. . .

+ +

52 | |

+-----------------------------------------+-----------------------------------------+

54 | Product |

+ +

. . .

. . .

. . .

+ +

84 | |

+-----------------------------------------+-----------------------------------------+

86 | Revision |

+ +

. . .

. . .

. . .

+ +

96 | |

+-----------------------------------------+-----------------------------------------+

## Ping

This message is sent from a client to a device. It is used to check if a device is active. An Acknowledge message will be sent by the device in response.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 0 | Command = 2 |

+-----------------------------------------+-----------------------------------------+

## Acknowledge

This message is a generic ACK message that will be sent in response to all requests made by clients that do not require returning an additional data payload in the response. The Message ID field should be sufficient to determine which message is being ACKed.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 0 | Command = 3 |

+-----------------------------------------+-----------------------------------------+

## Request Extended Device Information

Sent by a client to a device in order to obtain additional information about the device that is not included in the Reply Device Information message from protocol 0.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 0 |

+-----------------------------------------+-----------------------------------------+

## Reply Extended Device Information

Sent by a device to a client in response to a Request Extended Device Information message.

### Field Descriptions

|  |  |
| --- | --- |
| LEX/REX | 0=Device is a LEX, 1=Device is a REX |
| Paired With MAC Address | MAC address of a device that this device is paired with. This field is optional and may be repeated up to 7 times. |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 1 |

+-----------------------------------------+-----------------------------------------+

10 | LEX/REX | Paired With MAC Address |

+--> +-----------------------------------------+ +

| 12 | |

| + +

| 14 | |

| + +-----------------------------------------+

| 16 | |

+--> +-----------------------------------------+

|

+--- Repeated 0 or 1 times for a REX or a LEX in point-to-point mode or 0 to 7 times for a LEX with virtual hub enabled

## Pair To Device

Sent by a client to a device to instruct a device to try to pair with a different device specified in this message. A client must send this message to a LEX and a REX to instruct them to pair together, but the order of the two messages does not matter. The device will respond with an Acknowledge message if it is able to pair with a new device or a Negative Acknowledge message otherwise. The transmission of the Acknowledge message only indicates that an attempt will be made to establish a link between the devices, not that a link is already established.

### Field Descriptions

|  |  |
| --- | --- |
| Pair To Device MAC Address | The MAC address that the client is telling the device to attempt to pair with. |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 2 |

+-----------------------------------------+-----------------------------------------+

10 | Pair To Device MAC Address |

+ +

12 | |

+ +

14 | |

+-----------------------------------------+-----------------------------------------+

## Remove Device Pairing

Sent by a client to a device to instruct a device to discard any existing pairing it has. This will effectively disconnect any USB devices that were downstream of the remote extender. The client must send a Remove Device Pairing message to each of the devices in the pairing. The device will send an Acknowledge message in response to a Remove Device Pairing message or a Negative Acknowledge if the device is already unpaired or paired to a different device than the one specified.

### Field Descriptions

|  |  |
| --- | --- |
| Paired MAC Address | The MAC address that the client is telling the device to disassociate from. |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 3 |

+-----------------------------------------+-----------------------------------------+

10 | Paired MAC Address |

+ +

12 | |

+ +

14 | |

+-----------------------------------------+-----------------------------------------+

## Request Device Topology

Sent by a client to a LEX device in order to obtain the set of USB devices in the system. A REX device will send a Negative Acknowledge message in response to this message.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 4 |

+-----------------------------------------+-----------------------------------------+

## Reply Device Topology

Sent by a LEX device in response to a Request Device Topology message. This message is of variable length depending on the number of devices that are in the system. The combination of the information is enough for a client to build and display a device tree.

### Field Descriptions

|  |  |
| --- | --- |
| USB Address | An integer from 0 to 127. |
| USB Address Of Parent | An integer from 1 to 127. If a USB Address is seen which is not listed as the USB Address Of Parent for any of the devices, then that device is the root of the device topology. |
| Port On Parent | An integer from 1 to 127. 0 is not a valid number for a port on a hub, so this field will only be 0 if there is no USB device upstream before the host. |
| Is Device A Hub | 0=FALSE, 1=TRUE |
| USB Vendor Id | The USB vendor id from the device descriptor. |
| USB Product Id | The USB product id from the device descriptor. |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 5 |

+--> +-----------------------------------------+-----------------------------------------+

| 10 | USB Address | USB Address Of Parent |

| +-----------------------------------------+-----------------------------------------+

| 12 | Port On Parent | Is Device A Hub |

| +-----------------------------------------+-----------------------------------------+

| | USB Vendor Id |

| +-----------------------------------------------------------------------------------+

| | USB Product Id |

+--> +-----------------------------------------------------------------------------------+

|

+--- Repeated 0 to MAX\_USB\_DEVICES(= 32) times

## Use DHCP

Sent by a client to a device to tell a device that it should use DHCP to obtain an IP. This message may be sent as either as a UDP broadcast packet or a packet directed to a specific IP in the case that the device has a valid, known static IP address already. Regardless of whether the message was sent as a broadcast or not, the device will only switch into DHCP mode if the Target MAC Address field matches the MAC address of the device. When a valid Use DHCP message is received the device will send an Acknowledge message from its current IP address before discarding its static address configuration and beginning acquisition of an IP address via DHCP. If a Use DHCP message is received when the device is already in DHCP mode, the device will send an Acknowledge message, but this will not trigger any other action on the device such as IP renewal. The client is able to tell which mode a device is in by inspecting the Network Acquisition Mode field of the Reply Device Information message.

### Field Descriptions

|  |  |
| --- | --- |
| Target MAC Address | The MAC address of the device which will be set to use DHCP to obtain an IP address. |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 6 |

+-----------------------------------------+-----------------------------------------+

10 | Target MAC Address |

+ +

12 | |

+ +

14 | |

+-----------------------------------------+-----------------------------------------+

## Use Static IP

Sent by a client to a device to tell a device that it should use the static network configuration contained within this message. The IP, subnet mask and default gateway as well as the network configuration are stored in permanent storage, so the device will keep the same network configuration after being power cycled. Similarly to the Use DHCP message, this message may be broadcast or sent to a specific device. An acknowledge message will always be sent back to the client when a Use Static IP message is received by a device providing that the Target MAC Address parameter matches the MAC address of the device. Sending a Use Static IP message to a device already in a static configuration will enable a client to change the IP, subnet mask or default gateway of the device.

### Field Descriptions

|  |  |
| --- | --- |
| Target MAC Address | The MAC address of the device which will be set to use static network configuration. |
| IPv4 Address | The IPv4 address being assigned to this device encoded as a 32 bit integer. |
| Subnet Mask | The subnet mask of the network that this device is on. |
| Default Gateway | Sets the default gateway of the device. |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 7 |

+-----------------------------------------+-----------------------------------------+

10 | Target MAC Address |

+ +

12 | |

+ +

14 | |

+-----------------------------------------+-----------------------------------------+

16 | IPv4 Address |

+ +

18 | |

+-----------------------------------------+-----------------------------------------+

20 | Subnet Mask |

+ +

22 | |

+-----------------------------------------+-----------------------------------------+

24 | Default Gateway |

+ +

26 | |

+-----------------------------------------+-----------------------------------------+

## Negative Acknowledge

This message is a generic NAK message that may be sent in response to a Pair To Device, Remove Device Pairing or Request Device Topology message. It indicates to the client that their request was received, but that no action will be taken as a result of that message. The Message ID field should be sufficient to determine which message is being NAKed.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 8 |

+-----------------------------------------+-----------------------------------------+

## Use Filtering Strategy

Sent by a client to a device to tell the device that it should use a certain type of filtering strategy contained within this message. The filtering strategy denotes which type of devices will be filtered out by the extenders. An acknowledgement message will be sent back to the client if the extender supports device class filtering, and a valid strategy was selected. Otherwise, a NAK will be sent to the client.

### Field Descriptions

|  |  |
| --- | --- |
| Filtering Strategy | 0: Allow all devices  1: Block all devices except HID and hub  2: Block mass storage devices  3: Block all devices except HID, hub, and smartcard  4: Block all devices except audio and vendor specific |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 9 |

+-----------------------------------------+-----------------------------------------+

10 | Filtering Strategy |

+-----------------------------------------+

## LED Locator On

This message is sent from a client to a device. Upon receiving this message, the led pattern is started on the device. It is used to locate a specific device.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 10 |

+-----------------------------------------+-----------------------------------------+

## Led Locator Off

This message is sent from a client to a device. Upon receiving this message, the led pattern is stopped on the device. It only works when the led pattern is active on the device.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 11 |

+-----------------------------------------+-----------------------------------------+

## Reset Device

This message is sent from a client to a device. Upon receiving this message, the device resets.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 12 |

+-----------------------------------------+-----------------------------------------+

## Request Configuration Response Data

This message is sent from the client to a device in order to solicit a Reply Configuration Response Data message.

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 13 |

+-----------------------------------------+-----------------------------------------+

## Reply Configuration Response Data

This message is sent from a device to a client in response to a Request Configuration Response Data.

### Field Descriptions

|  |  |
| --- | --- |
| High Speed | 0=Disabled, 1=Enabled |
| MSA | 0=Disabled, 1=Enabled |
| Vhub | 0=Disabled, 1=Enabled |
| Current Filter Status | 0 - No filter  1 - Block mass storage devices  2 - Block all but HID and Hub devices  3 - Block all but HID, HUB and smartcard devices  4 - Block all but Audio and Vendor Specific devices |
| IP Acquisition Mode | 0=DHCP, 1=Static |
| Reserved | This field is reserved by Icron and is set to 0 |
| MAC Address | The device's MAC address |
| Paired With MAC Address | MAC address of a device that this device is paired with. This field is optional and may be repeated up to 7 times |
| Port Number | Port number that this device is connected to |
| IP Address | The device's current IP address |
| Subnet Mask | The subnet mask of the device |
| Default Gateway | The default gateway for the device |
| DHCP Server | The DHCP server of the device |
| Num of Vhub ports | The number of downstream ports of the device |
| VID | The Vendor ID of the device |
| PID | The Product ID of the device |
| Brand ID | The Brand ID of the device |
| Vendor | A 32 byte NUL terminated string containing the device's vendor name |
| Product | A 32 byte NUL terminated string containing the device's product name |
| Revision | A 12 byte NUL terminated string containing the device's revision number |

Byte Offset

+-----------------------------------------+-----------------------------------------+

0 | Magic Number |

+ +

2 | |

+-----------------------------------------+-----------------------------------------+

4 | Message ID |

+ +

6 | |

+-----------------------------------------+-----------------------------------------+

8 | Protocol Version = 3 | Command = 14 |

+-----------------------------------------+-----------------------------------------+  
 10 | High Speed status | MSA status |  
 +-----------------------------------------+-----------------------------------------+

12 | Vhub status | Current Filter Status |

+-----------------------------------------+-----------------------------------------+

+-----------------------------------------+-----------------------------------------+  
 14 | IP Acquisition Mode | Reserved |  
 +-----------------------------------------+-----------------------------------------+

16 | MAC Address |

+ +

18 | |

+ +

20 | |

+-----------------------------------------+-----------------------------------------+

22 | Paired with MAC Address |

+ +

. . .

. . .

. . .

+ +

62 | |

+-----------------------------------------+-----------------------------------------+

64 | Port Number |

+-----------------------------------------+-----------------------------------------+

66 | IP Address |

+ +

68 | |

+-----------------------------------------+-----------------------------------------+

70 | SubNet Mask |

+ +

72 | |

+-----------------------------------------+-----------------------------------------+

74 | Default Gateway |

+ +

76 | |

+-----------------------------------------+-----------------------------------------+

78 | DHCP Server |

+ +

80 | |

+-----------------------------------------+-----------------------------------------+

82 | Number of Vhub Ports | Reserved |

+-----------------------------------------+-----------------------------------------+

84 | VID |

+-----------------------------------------+-----------------------------------------+

86 | PID |

+-----------------------------------------+-----------------------------------------+

88 | Vendor |

+ +

. . .

. . .

. . .

+ +

118 | |

+-----------------------------------------+-----------------------------------------+

120 | Product |

+ +

. . .

. . .

. . .

+ +

150 | |

+-----------------------------------------+-----------------------------------------+

152 | Revision |

+ +

. . .

. . .

. . .

+ +

164 | |

+-----------------------------------------+-----------------------------------------+

# Appendix A

## Abbreviations

LEX – Local Extender

REX – Remote Extender

UDP – User Data Protocol

USB – Universal Serial Bus

DHCP – Dynamic Host Configuration Protocol

IP – Internet Protocol

IPv4 – Internet Protocol version 4

TBD – To Be Determined

ACK – Acknowledgement

NAK – Negative Acknowledgement

MAC Address – Media Control Access Address

HID – Human Interface Device

## Glossary

## References

<https://en.wikipedia.org/wiki/IPv4_subnetting_reference>

## Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Version** | **Date** | **Author** | **Reason for Change** |
| A01 – A03 |  | David Frey | Original author |
|  | 23/06/2016 12:55:56 PM |  | Updated filtering options in ‘Use Filtering Strategies’ |
|  |  |  |  |

## Document Approval

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name** | **Signature** | **Date** |
| **Manager** |  |  |  |
| **Supervisor** |  |  |  |
| **President** |  |  |  |