Alpaca Discovery

Draft 0.5

Introduction

Clients can discover Windows COM based drivers through the ASCOM's registry-based Chooser capability, however, Alpaca devices can run on any operating system and may be on separate devices to clients. In consequence, Alpaca devices need a discover mechanism to enable clients to be aware of their existence and this document describes the Alpaca Discovery Protocol and provides advice on implementation.

Definitions

For the following document Device will refer to something (a driver or device) that exposes the Alpaca interface and Client will refer to client applications that want to locate and use the Device's API(s).

- **DISCOVERY PORT**: this is the port to which the Client Broadcasts the discovery message and on which the Device listens. The Alpaca default discovery port is 32227.
- **DISCOVERY MESSAGE**: is the message sent by the client via broadcast on the DISCOVERY PORT.
- **RESPONSE MESSAGE**: is the message that the Device sends back via unicast to the client.
- **ALPACA PORT**: is the port on which the Alpaca management and device APIs are available.
- **ASCOM DEVICE**: An implementation of an ASCOM device interface such as ITelescope or IFocuser that can be accessed through the Alpaca Device API protocol.
- **UNIQUE ID**: A string identifier for an ASCOM DEVICE that is globally unique.
- **ALPACA DEVICE:** Hardware or software that supports the Alpaca Management and Alpaca Device API protocols to provide access to one or more ASCOM DEVICES.

Alpaca Discovery Protocol - IPv4

Clients

Clients find devices through a UDP protocol (see Figure 1 - Alpaca IPv4 and IPv6 discovery protocol) that uses:

- the IPv4 network broadcast address
- a designated IP port number, whose default is 32227
- a structured DISCOVERY MESSAGE
- a structured RESPONSE MESSAGE

To search for and use ALPACA DEVICES, a client should:

1. Transmit a DISCOVERY MESSAGE to the DISCOVERY PORT by broadcast (IPv4).
2. Use the IP address from the RESPONSE MESSAGE together with the ALPACA PORT from the DISCOVERY RESPONSE to query the Alpaca Management API to determine which ASCOM DEVICES and device types are available.
3. When selected by the user, access specific devices through the ALPACA DEVICE API that also runs on the ALPACA PORT at the IP address of the initiator of the RESPONSE MESSAGE.

Devices

To listen for IPv4 DISCOVERY MESSAGEs, Alpaca devices should:

1. Listen for IPv4 broadcasts on the DISCOVERY PORT
2. Assess each received message to confirm whether it is a valid DISCOVERY MESSAGE.
3. If the request is valid, return a RESPONSE MESSAGE indicating the device's ALPACA PORT.

The following figure gives a conceptual overview of the IPv4 and IPv6 discovery processes.

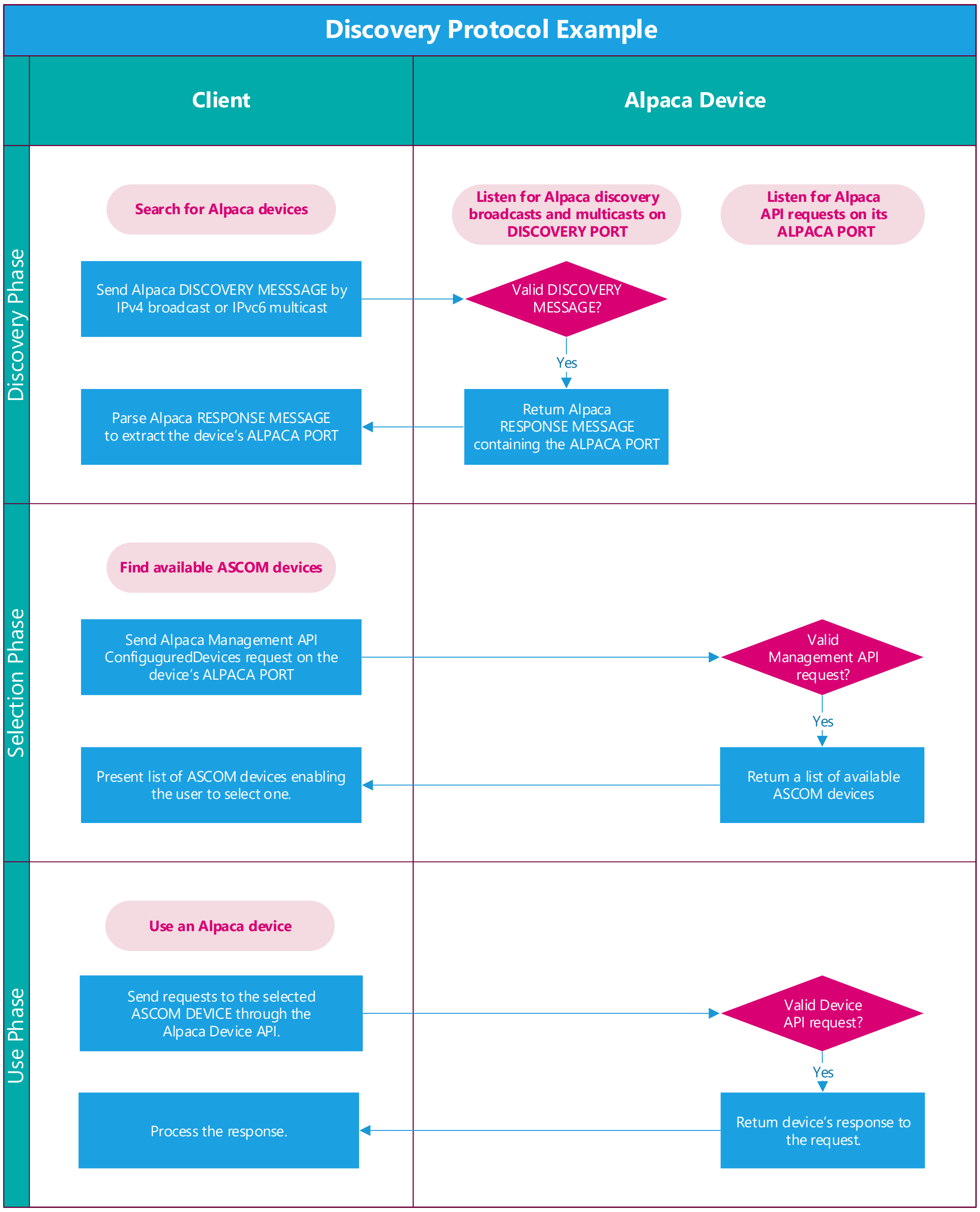
Discovery Protocol Example
Client
Alpaca Device
Discovery Phase
Search for Alpaca devices
Listen for Alpaca discovery broadcasts and multicasts on DISCOVERY PORT
Listen for Alpaca API requests on its ALPACA PORT
Send Alpaca DISCOVERY MESSSAGE by IPv4 broadcast or IPvc6 multicast
Valid DISCOVERY MESSAGE?
Yes
Parse Alpaca RESPONSE MESSAGE to extract the device's ALPACA PORT
Return Alpaca RESPONSE MESSAGE containing the ALPACA PORT
Selection Phase
Find available ASCOM devices
Send Alpaca Management API ConfigguredDevices request on the device's ALPACA PORT
Valid Management API request?
Yes
Present list of ASCOM devices enabling the user to select one.
Return a list of available ASCOM devices
Use Phase
Use an Alpaca device
Send requests to the selected ASCOM DEVICE through the Alpaca Device API.
Valid Device API request?
Yes
Process the response.
Return device's response to the request.

FIGURE 1 - ALPACA IPV4 AND IPV6 DISCOVERY PROTOCOL

Alpaca Discovery Protocol - IPv6

Clients

Clients find devices through a UDP protocol (see Figure 1 - Alpaca IPv4 and IPv6 discovery protocol) that uses:

- the fixed IPv6 link local multicast address: ff12::a1:9aca
- a designated IP port number, whose default is 32227
- a structured DISCOVERY MESSAGE
- a structured RESPONSE MESSAGE

To search for and use ALPACA DEVICES, a client should:

1. Transmit a DISCOVERY MESSAGE to the DISCOVERY PORT using IPv6 multicast address ff12::a1:9aca.
2. Use the IP address from the RESPONSE MESSAGE together with the ALPACA PORT from the DISCOVERY RESPONSE to query the Alpaca Management API to determine which ASCOM DEVICES and device types are available.
3. When selected by the user, access specific devices through the ALPACA DEVICE API that also runs on the ALPACA PORT at the IP address of the initiator of the RESPONSE MESSAGE.

Devices

To listen for DISCOVERY MESSAGEs, Alpaca devices should:

1. Join the Alpaca IPv6 multicast group on address ff12::a1:9aca.
2. Listen for Alpaca IPv6 multicasts on the DISCOVERY PORT
3. Assess each received message to confirm whether it is a valid DISCOVERY MESSAGE.
4. If the request is valid, return a RESPONSE MESSAGE indicating the device's ALPACA PORT.

Discovery Message Format

To provide for future extension, if required, the DISCOVERY MESSAGE has a structured format:

Byte Number	Content
`0::14`	Fixed ASCII text: **`alpacadiscovery`**
`15`	ASCII Version number: 1 for the current version. The version number sequence is 1::9 then A::Z
`16::63`	ASCOM reserved for future expansion

Table 1 - Discovery message format

The current, version 1, discovery message therefore contains 16 bytes, comprising 15 bytes from the ASCII text alpacadiscovery together with a single ASCII version byte:

`alpacadiscovery1`

```
Hex: 0x61, 0x6C, 0x70, 0x61, 0x63, 0x61, 0x64, 0x69, 0x73, 0x63, 0x6F, 0x76, 0x65, 0x72, 0x79, 0x31
```

The discovery message "alpacadiscovery" has been registered to ASCOM in the IANA service registry:

https://www.iana.org/assignments/service-names-port-numbers

Discovery Response Format

The ALPACA DEVICE response must be a JSON object containing the device's ALPACA PORT e.g.:

```
{
  "AlpacaPort":12345
}
```

Unique IDs (UID)

An ASCOM DEVICE’s UID is returned within the Alpaca Management API ConfiguredDevices response.

The UID is an ASCII string that MUST be unique to each ASCOM DEVICE. Its purpose is to help clients re-discover a previously used ASCOM DEVICE if its IP address changes.

1. The UID must be derived from a 48bit or larger space and converted to an ASCII string.
2. The UID must be exposed through the **UniqueID** field of the Alpaca Management API ConfiguredDevices response.
3. Manufacturers and developers must use appropriate algorithms to ensure that otherwise identical devices have different UIDs.
4. Alpaca Devices MUST send the same UIDs on every network interface to which the device is attached.
5. Once a UID has been assigned to an ASCOM DEVICE, it must never change. This means that:
    a. An ASCOM DEVICE served by an ALPACA DEVICE will always be uniquely identifiable through the assigned UID .
    b. UID must be retained when devices are powered down.

Approaches for generating UIDs are described in *Reference to Daniels cookbook*