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Distributed Control of ATM Networks

ATM Signalling for Dumb Devices

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Abstract

The report outlines a signalling protocol which facilitates connecting dumb devices to ATM networks. The Dumb Device Protocol support signalling externally to the device.

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ATM Signalling for Dumb Devices

1 Introduction

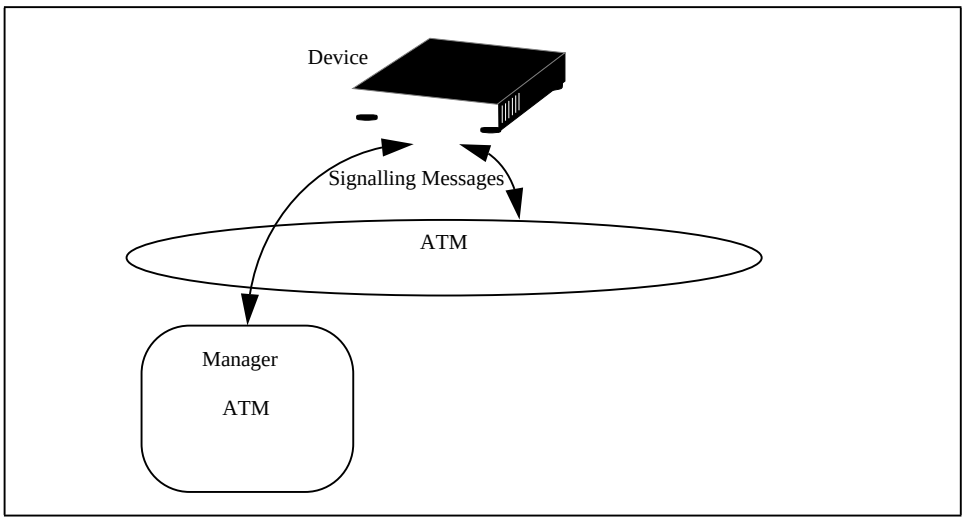
A central aspect of DCAN is its support for connecting dumb devices to ATM networks. This document proposes a signalling protocol designed for this purpose. This protocol, the Dumb Device Protocol (DDP), is designed to support the implementation of standards based ATM signalling (e.g. UNI 3.1) externally to the device. Section 2 discusses this in more detail.

DDP signalling messages are sent from the device to the switch; no messages are sent from the switch to the device. These messages are used to identify the device to the switch and to indicate what signalling protocol should be used by the switch for this device. As with all ATM signalling a particular VCI must be assigned for sending signalling messages from the device to the switch.

Section 2 describes the concept of proxy signalling, section 3 provides a functional overview of DDP, section 4 illustrates DDP in use and section 5 defines DDP message formats.

2 Proxy Signalling

Proxy Signalling is a technique by which ATM signalling is implemented on behalf of dumb devices by software running externally to the device. The entity implementing signalling is called the *Manager*. Figure 2-1 illustrates this relationship. The device acts as a relay between the ATM network and the manager, i.e. forwards all signalling messages received from the network to its manager and vice versa. This means that the device appears to be the producer and consumer of all signalling messages sent to and received from the ATM network. From the network's point of view this configuration is indistinguishable from the case where the ATM signalling is implemented within the device itself rather than by a third party (the manager).



This approach requires that a communication path exists between the device and its man-

ager. The nature and provision of this path is beyond the scope of DDP, i.e. existing ATM technology should be used. Various options are available, including the use of Permanent Virtual Circuits (PVCs). Once configured PVCs are remembered by the network and require no further interaction with the signalling protocols. All ATM networks support PVCs, although their setup and management is implementation dependent and varies from vendor to vendor.

The manager can run on any host (or even switch) which has an appropriate communication path (for forwarding signalling messages) to the device being managed.

3 DDP Functional Overview

DDP functionality falls into the following categories:

Device Identification: dumb devices need to be identified. Sufficient information to associate a device with its manager is required. The device vendor, type and serial number can be used. If multiple devices are somehow connected to the same switch port then the ATM Virtual Path Identifier can be used to distinguish between them, i.e. each device would be assigned a different VP and the switch would treat each one as a separate signalling entity.

Device Registration: devices identify themselves to the switch to which they are connected. DDP specifies the form of this interaction.

Device Registry: the switch must remember which devices (i.e. their identity) are connected to which port. Access to this information can be provided via existing switch management protocols (e.g. SNMP).

Signalling Initiation: a manager (via the dumb device) must instruct the switch as to which signalling protocol is to be used. DDP specifes the format of this interaction. Note that the dumb device must appear to originate this interaction - i.e. it appears that it is the device which is asking for a particular signalling protocol to be used.

Device identification and signalling initiation require signalling messages to be sent by the device and to be acted upon by ATM switches. These messages are sent over the DDP Signalling VCI and their format is defined in section 5.

ATM switches must implement the device registry, the overhead of doing so is intentionally kept to a minimum. A registry entry is required for every ATM Virtual Path which has a device attached to it. The format of the each entry is defined to be the same as the DDP Identification Message defined in section 5. The device identification message is defined as being idempotent and hence the device may periodically retransmit this information.

Keeping the resigtry information in the switch provides a compromise between complexity and performance. Maintaining the registry is a simple operation within a switch and requires no further changes to signalling protocols. If swiches were required to export the registry to some third party then a protocol changes would be required. Although exporting the registry could lead to better performance (i.e. avoid the need to poll switches to obtain their registry) the increased complexity makes it unlikely that it would ever be widely adopted.

The switch must listen for DDP message identification messages and on their reception record the identity of the device. In addition, they must make this identity information

available via their normal manager interfaces. This allows applications to be written which browse the network (by interrogating switches) for dumb devices and to then associate the devices found with an appropriate manager. In most instances it will be the manager itself which searches the network for a device to manage (e.g. a manager is started for a given device type, vendor and serial number).

4 DDP Step-by-Step Operation

This section illustrates the operation of DDP on a step-by-step basis. It also defines the action to be taken by ATM switches on reception of a given DDP message.

1. the device identifies itself to its ATM switch by sending a DDP Identification message. This message is idempotent and the device may periodically retransmit the message.

2. on receiving the DDP Identification message the switch must first disable all further signalling activity on the receiving port and then enter the device's identification information in its registry.

3. a DDP application scans the network for a dumb device to manage. It retrieves the device's identifcation information from the ATM switch's registry and uses it to locate a manager for that device. It must then communicate the location (e.g. switch, port, NSAP components) to the manager.

4. the manager establishes a connection to exchange signalling messages with the device. DDP explicitly precludes defining the mechanism to be so used. Possible mechanisms, include PVC's or "third party" signalling.

5. the manager establishes communication with the device and decides which signalling protocol to use.

6. the manager instructs the device to send a DDP Signalling Initiation message to the switch indicating which signalling protocol is to be used. This message is idempotent and may be retransmitted periodically.

7. on receipt of a DDP Signalling Initiation message the switch re-enables signalling on the receive port using the signalling protocol specified in the message.

It can be seen from the preceeding explanation that DDP is a very simple protocol. It has only two messages and these are intentionally idempotent to allow for a simple retransmission strategy. The bulk of the work is performed outside of the network (by manager's and DDP applications which browse the network for dumb devices to be managed). In this way the impact on the network and switch software in particular is kept to a minimum.

5 DDP Messages and VCI

All DDP messages are sent using AAL5 over the DDP Signalling VCI which is VCI ???.

5.1 DDP Identification Message

The Identification message includes the following fields:

Type: 32 bit value

Vendor: 32 bit value

Serial: 48 bit value

The Type and Vendor values are allocated by a single organisation to ensure uniqueness (much like Ethernet MAC addresses).

This message is idempotent and may be retransmitted periodically.

5.2 DDP Signalling Initiation

The Signalling Initiation message contains the following fields:

Signalling Protocol: 32 bit value

The Signalling Protocol values are allocated by a single organisation.

6 Summary

DDP is a simple protocol, with only two idempotent messages. Idempotency is important since it provides good error recovery at minimal complexity.

Care has been taken in the design of DDP to ensure that it has *no* impact on existing signalling standards and protocols. All that is required is that a signalling VCI be reserved for DDP and the switch software be updated to implement DDP and the associated registry.