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Supporting distance vector routing over device discovery flows in the pervasive middleware PalCom

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Abstract

PalCom is a pervasive middleware that enables users to combine services from different devices into assemblies, or usage scenarios. The mechanism of device discovery in PalCom builds an ad-hoc network of interconnected devices while replacing cross-network periodic keep-alive messages with timely forwarded events that notify devices about the discovery and undiscovery of each other. Moreover, the device discovery mechanism is decoupled from any specific routing decisions mechanism. In this paper, we present a design that builds on this flexibility to add distance vector routing to PalCom while inheriting the event based cross-network device discovery for updating routing tables on interacting devices. The proposed design has been implemented and evaluated against a network with links that continuously change their availability.

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Keywords: pervasive middleware; device discovery; ad-hoc networking.

1. Introduction

PalCom is a pervasive middleware that enables users to integrate services of different devices, possibly on different networks, into assemblies of use cases[1]. It provides a service discovery protocol that enables those devices to exchange their services descriptions. Using a tool that can display such descriptions in a user friendly interface, a user can write,

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or compose, simple services assembly scripts that enable exchanging data and commands among those devices. We refer to that approach as a human, or user, in the loop[1], where users are given more influence on system configuration and control.

As a previous work[2], we defined the lowest layer of the PalCom stack that enables third-party developers to write Media Abstraction Objects, MAOs, which abstract different types of network interfaces to upper PalCom layers. As an extension[3], we detailed a device discovery mechanism for PalCom that enables devices to discover each other and to build an ad-hoc network among themselves. For development purposes[3], we assumed to route a message to a destination node via the first discovered route to it. In this work we introduce distance vector routing in PalCom.

In this paper, we explain the design challenges, principles, options and details of supporting distance vector routing in PalCom. In section 2, we summarize our previous work on the PalCom stack[2, 3]. Also, we survey ad-hoc routing protocols to compare their signaling and control overhead with that of a routing protocol over our device discovery mechanism. Then, in section 3, we detail our design before we summarize its implementation and evaluation in section 4. Finally we explain our conclusions and future work in section 5.

2. Previous work

We build the support of distance vector routing in PalCom on top of our previous work of networking media abstraction[2] and device discovery in PalCom[3], which provides a signaling and control utility for supporting distance vector routing in PalCom.

2.1. Device discovery over networking media abstraction in PalCom

As shown in Fig. 1, our previous work[2] defines the lowest layer of the *PalCom stack* as *the Media Abstraction Layer, MAL*. It enables the development and integration of media abstraction objects, MAOs, that abstract different

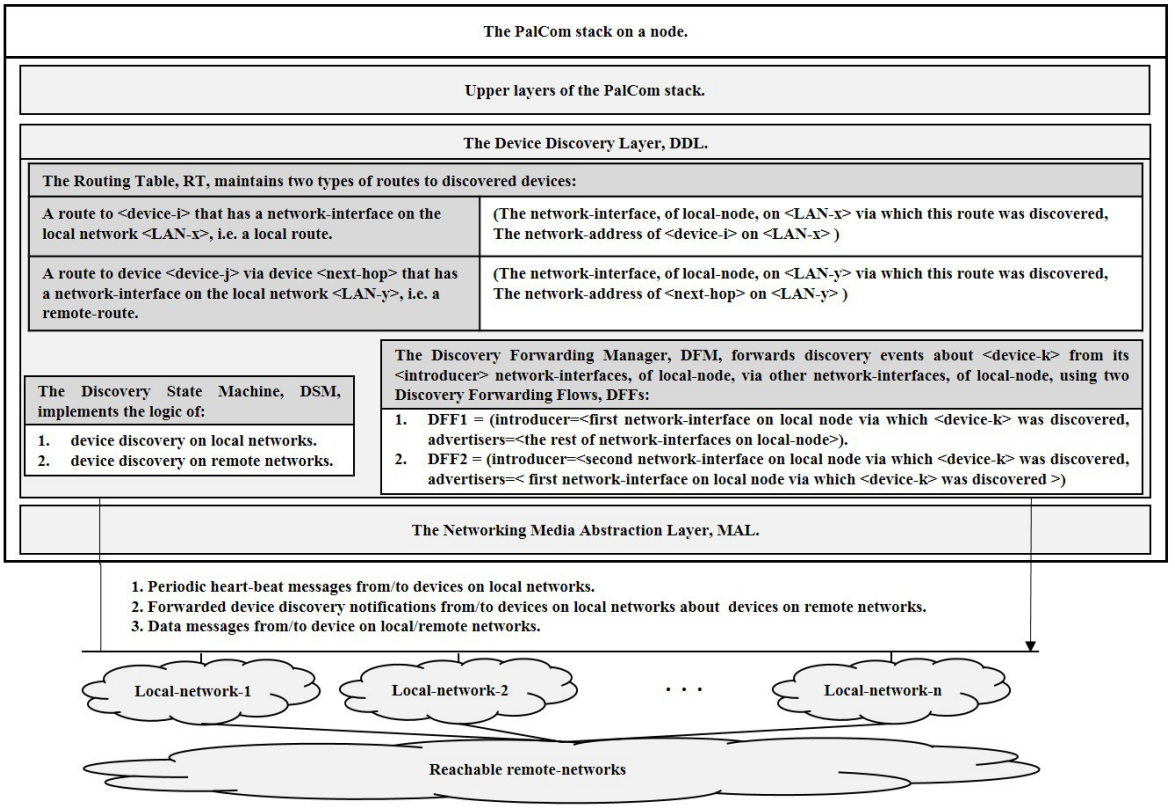

Fig. 1. The components and funcationality of the Device Discovery Layer, DLL, as part of the PalCom stack.