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Review

Collaborative distributed communication in heterogeneous environments: A comprehensive survey

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ABSTRACT

This paper presents the different aspects with the help of which the collaborative distributed communication in heterogeneous devices can be achieved based on existing techniques and methods. This paper gives a brief summary and analysis of the challenges existing in implementing the collaborative distributed communication in heterogeneous devices and how these challenges can be overcome by using some of the previously proposed techniques. This paper also presents the various different architectures used for collaborative distributed communication which were recently implemented and used. This paper also illustrates the possible existing solutions to the problems in providing collaborative environment with the help of some recently proposed protocols which provide efficient collaborative systems. In this paper by illustrating the models of distributed systems and various protocols to implement solution can help in building a proper design of collaborative system using which we can solve the problem of collaboration amongst heterogeneous devices. We can select appropriate distributed system architecture and suitable heterogeneous protocol for building collaborative system as per requirements. Such systems can be very helpful in scenarios where the communication infrastructure fails owing to natural calamity or any other reason like wars. In collaborative heterogeneous networks each node can act as individual data processing units which can use each other's processing power in collaboration to achieve a desired compute intensive or common goal.

Contents

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1. Introduction

The word collaboration refers to “A joint effort by a group of systems or peoples to achieve a common goal”. The mobile collaboration activities involve on-demand interaction amongst nomad users. Here we will refer to collaboration in a context of participation of system in the environment where the performance and usage of the system will improve. The collaborative communication is broadly classified as (i) Direct and Indirect, (ii) Active and Passive, (iii) Synchronous and Asynchronous, and (iv) Static and Dynamic (Rocha, 2005).

In *direct* the system reaches to its goal by directly interacting with the system. In *indirect* the collaboration is achieved with the help of other system participating in the collaboration and indirectly the collaboration is achieved. For example the hyperlinks in the web pages act as indirect collaborative agents for the Google to decide the destination of the corresponding web page in the environment.

In *active* collaborative environment nodes continuously participate in the environment through information sharing. But in *passive* one its not required for the node to continuously participate in the system rather it adds value to the system by enriching its performance at given amount of time e.g. BitTorrent. In this the bandwidth is shared amongst the participating nodes in communication rather than storing the information in the dedicated system and allocating the bandwidth to it.

Real time communication (e.g. messaging, video conferencing) requires *synchronous* collaborative communication. While the best example of *asynchronous* collaboration is the wiki pages in the wikipedia where the page can be edited by the user at any time by the user achieving the asynchronous collaboration.

Static collaboration means that the collaboration takes place mostly around fixed pieces of information. But in the *dynamic* collaboration task is performed by dynamic interaction of the processes e.g. Google maps where the maps link the information regarding any searched location dynamically with the required map enriching the value of resultant search giving user the total information regarding the searched location.

The rest of this paper is organized as follows. Section 2 illustrates the different architecture of distributed systems which form the foundation for collaborative communication. Section 3 provides architectural overview of distributed mobile collaborative systems. Section 4 provides peer-to-peer(P2P) networking in collaborative communication. Section 5 highlights some of the challenges in P2P mobile ad hoc networks. In Section 6 solutions to problems in P2P mobile ad hoc networks are presented. Section 7 presents how collaborative communication can be achieved with the help of ad hoc networks. Finally, Section 8 concludes this paper.

2. Models of distributed systems

The various models of distributed systems are introduced here in order to understand the structure, organization, placement of components, interactions and fundamental properties of distributed systems such that the proper selection of distributed systems can be made so as to achieve collaborative distributed systems in heterogeneous environments. Based on survey we can classify and identify different implementations along with their strengths and weaknesses. Based on this analysis we can build a new system analyzing pre-validated building blocks. There are three basic models of distributed systems. These are (1) Physical model, (2) Architectural model, and (3) Fundamental model (Müller-Birn).

2.1. Physical model

The physical model is nothing but the hardware composition of the system in terms of computers, other devices and their interconnection network. A physical model is a representation of the underlying hardware elements of a distributed system that