The Cooperative Communication Method of the Converged Multi-media Wireless Resource Management Network
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Abstract

This paper describes a cooperative communication method of the converged multi-media wireless resource management network. It can maximize the utilization of heterogeneous network resources and optimize the access to wireless resources of the network in the form of Mesh, which solves the problem of collaborative wireless resource management in multi-media converged networks. Through the overall consideration of multi-media converged networks including wired network, wireless network, broadband network, and narrowband network, joint access control and resource scheduling for network devices with different characteristics in heterogeneous networks are realized.

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1. Introduction

The rapid development of wireless network technology has not only significantly improved network coverage, network capacity, transmission rate, and service quality, but also presents the development trend of diversification of access modes, higher speed of data transmission, universal mobility and full IP integration. Being different from wired communication, wireless transmission media are uncertain and susceptible to unpredictable interferences such as noise, multipath fading, and shadow effect. Moreover, the inherent mobility of wireless transmission media also does harm to channel prediction and channel estimation. It brings considerable problem, which increases the bit error rate of the channel. In order to ensure the availability of wireless communication, the conservative design is often performed according to the requirements of the lowest channel performance, rather than adaptively adjusting to adapt to the communication channel. It makes the protocol stack unable to effectively and reasonably utilize limited power resources and spectrum resources.

However, existing wireless communication methods ignore the correlation between the overall requirements of network design and the functions of each layer. Each layer of the protocol stack is designed and operated independently, and between layers and layers only exist interfaces which are static and independent of the limitation and application of each network layers. This rigorous layering design method lacks flexibility, compatibility, and does not fit well into the characteristics of today’s networks. In the practical network communication process, the information between layers is difficult to share, which also adds a large number of uncontrollable link overheads, information redundancy, and communication overhead between peer layers.

The cooperative communication method of the converged multi-media wireless resource management network described in the proposal can easily solve these problems. It can change the link type and facilitate cross-layer design, which not only realizes device independence, but also achieves the effect communication between high-level applications and underlying channels.
2. Conventions used in this document

2.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

2.2. Protocol Stack

The protocol stack, is a specific software implementation of the computer network protocol suite. A protocol in a protocol suite is usually designed for one purpose only, which makes the design easier. Each protocol module can usually be treated as a layer in the protocol stack, because it typically communicates with two other protocol modules. The lowest level protocol always describes the physical interaction with the hardware. The user applications only handle the top-level protocols.

2.3. Wireless Pipe

Wireless Pipe - phytype = "atheros", refers to wireless mesh_Pipe based on wlan_mwds;

2.4. Ethernet Pipe

Ethernet Pipe - phytype = "ethernet", refers to the two-layered wired mesh_Pipe in the same broadcast domain;

2.5. Ip Tunnel Pipe

Ip_tunnel Pipe - phytype = "ip_tunnel" is used to establish a three-layered mesh network across the LAN. It can be divided into two modes: active one and non-active one according to different working modes.

2.6. Ip Pipe

Ip Pipe - phytype = "ip", which refers to the ability to extend other types of links based on the change of the three-layered wired mesh_Pipe in the same broadcast domain.

3. Joint Access Control and Resource Scheduling
3.1. Unified Interface

The cooperative communication method of the converged multi-media wireless resource management network can provide a unified standard Ethernet interface to users by adapting to protocol specifications of different media, so that coordination between network layer protocols can improve the overall performance and efficiency of the wireless network.

In practical applications, the protocol stack is usually divided into three main parts: media, transmission, and application. A particular operating system or platform often has two well-defined software interfaces: one between the media layer and the transport layer and the other between the transport layer and the application layer.

3.2. Different Assessment Standards

Different transmission quality assessment methods are adopted for different media, which requires effective implementation of network cross-layer radio resource management mechanism which assists in the design of cross-layer optimal relay node selection algorithm in cooperative relay network, and supports multi-hop self-organizing network cross-layer routing.

4. Maximization of the Heterogeneous Network Resources Utilization Rate

4.1. Flexible Networking

The IP Pipe and IP Tunnel are designed to be ones that can change the link type, which makes the network mode flexible.

4.2. Design Structure

Design structure: mesh - Pipe - link;

4.3. Service Interfaces

Pipe provides a standard Ethernet interface to Mesh. After being configured in the configuration file G8000.xml, then the Ethernet port can be treated as a Mesh Pipe. The type of the Box is Relay/Mobile/Gateway (dual Ethernet port). While the Ethernet port is used as the Mesh Pipe, it cannot be used as another role at the same time, such as access users, etc. For example, the device is connected to the Mesh Pipe through a standard Ethernet interface, and the Mesh Pipe provides standard adaptation interface to the external network.
4.4. Link Adaptation

The message format encapsulation and the transmission of corresponding control instructions are chosen according to different link transmission standards.

5. Classified Design of Mesh Pipe

Mesh Pipe’s classified design technique is mainly showed in the power control and adaptive modulation and demodulation control according to the QoS requirements of MAC protocol, routing protocol, TCP protocol and application layer services.

In the separate unit of a converged multi-media system, all Mesh Pipes will provide a unified Ethernet interface.

5.1. Design of Different Link Type

Two-layer and three-layer Pipe are designed according to different link types. Set two-layer Pipes for Ethernet and link types "ethos". Set three-layer Pipe for IP Tunnel.

--------------------------------------- | wired Pipe | fiber,covered wire |
| wired Pipe | scatter,radio,satellite |
| wireless | ---------------------------------------

5.2. Wired and Wireless Design

Designing wired and wireless Pipe is to set wired Pipe for fiber and covered wire devices, and to set wireless Pipe for scatter, radio and satellite devices, which achieves the wireless communication between heterogeneous multi-media.

5.3. Broadband and Narrowband Design

Setting broadband Pipe and narrowband Pipe according to the practical transmission rate of the device. A broadband Pipe is set for the fiber devices, and a narrowband Pipe is set for the scattering and the radio devices.

The structure can achieve multi-media convergence through the application of Mesh Pipe, and provide a unified network interface for business units, so the business units has the ability to cross media, and the business units only need standard Ethernet port access. For example, communication unit can be linked up to the converged multi-media wireless communication system not only through the Mac layer but also through the IP_tunnel Pipe using IP. Regardless of the
access, a unified standard Ethernet interface will be provided by the converged multi-media wireless communication system.

<table>
<thead>
<tr>
<th>broadband Pipe</th>
<th>fiber</th>
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<tr>
<td>narrowband Pipe</td>
<td>scatter, radio</td>
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6. Security Considerations

It is necessary to use the "network ID" to distinguish different ad hoc networks. Only the ad hoc network node devices (hereinafter referred to as nodes) configured with the same "network ID" can discover each other.

Nodes in the same ad hoc network use a unified pre-configured static key to encrypt the transmitted data. When the keys are different, nodes cannot transfer data. Even if the eavesdropper acquires the key seed by some means, he cannot get the final key.

And broadcast data packets and Mesh protocol packets are not encrypted.

7. IANA Considerations

This document does not include an IANA request.

8. Acknowledgements

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