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Cross Layer Optimization For Protocols In Mobile Adhoc Networks

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Abstract:

Cross-layer architecture, a new design paradigm that enables information sharing across the layers promises to achieve optimization of conflicting objectives that otherwise considered as independent of each other in the context of emerging applications of ad hoc networks. Quest for a high throughput, low latency and tangibly better scalability requirements of ad hoc network applications in present 3G/4G and future 5G standards become critical challenge without the aid of inter layer interaction. This paper discusses the perspective scope of cross-layer technologies in the context of ad hoc networks to meet the aspiration set forth under high user/traffic intensity applications.

Keywords: Cross layer design, MANET, optimization, mobility, medium access control protocol.

1. INTRODUCTION

An ad hoc network refers to category of wireless networks that are portable with connected devices which have an identical status on a network and undisputed movement facility. The nodes are free to associate with other available nodes provided they are under its communication range, must act as router/relay and have the responsibility to control plus organize the network effectively. The advantages of ad hoc networks like mobility, flexibility, resilience and independence of fixed infrastructure spark off many vision based applications in several fields. Some of them are mission critical emergency crisis management services to instantaneously set up the network with lower cost, business environment that require collaborative computing outside the office environment and game theory that deals with multi-person decision making, in which each decision maker tries to maximize his utility. The Personal Digital Assistant (PDA)s, such as wearable computers and smart phones having, Wi-Fi and IEEE 802.15 technologies are being used to develop applications like off-campus Based on their purpose of usage the wireless ad hoc networks are distinguished in three categories; Mobile Ad hoc NETwork (MANET) that consist of devices like smart phones and laptop computers, Vehicular Ad hoc NETwork (VANET) composed of travelling cars to create a mobile network and Wireless Sensor Network (WSN) made up of autonomous sensors to control the environmental actions [2]. The dynamic Quality of Service (QoS) requirements in emerging multimedia service based applications of MANETs are always challenging for the reason that communication link is mostly time varying natured. The Cross Layer Design (CLD) approach based on interaction that allows for fine tuning and dynamic adaptation of parameters of protocol during design phase to optimally allocate critical resources in run time has emerged as one of the solution in several applications of MANETs. Mobility of nodes in MANETs poses challenges like; more frequent path breaks and suboptimal path. Though dynamic network topology higher the chances for node to break its link with neighbor node, at the same time it higher the possibilities of discovering shorter path to its destination in case mobility follows group mobility pattern. Generally it is possible to

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setup interlayer interaction across the layers in a timely manner during network operation for sharing information between layers to ensure adaptability and to produce higher network efficiency for given QoS guarantee.

2. RELATED WORK

The specific traits of MANET's pose challenges to network protocol design of its layers. The lowest layer called physical layer must concern with instantaneous changes in the link features. The media access control (MAC) layer that handle fair channel access, packet collision conditions has to deal with hidden node and/or exposed node problems. Node cooperation to discover and maintain optimal path is required at network layer. The transport layer need to be capable of handling loss of packets and delay feature that sounds different from wired networks counter parts. Various possible disconnections and reconnections are taken care in application layer. Moreover, developments of all network protocols need to interface smoothly with traditional network architecture to consider possible security issues and QoS needs.

Application Layer	Energy management Quality of service Security and cooperation Mobility management	Group Communication, Service Locations
Transport Layer		Transport Layer Protocols
Network Layer		TCP/IP routing, Addressing, Forwarding
MAC Layer		Framing, Error Detection and Control, Congestion
Link Layer		Antennas, MAC, Bluetooth, Power Control, 802.11, Hyper LAN.

Fig. 2 MANET functions sharing between different layers through CLD

Most of protocols proposed for MANETs assume layered architecture design which is highly rigid or strict and each layer specific protocol architecture is only concentrated about the interface to neighboring layers. In recent years, due to availability of several enabling technologies the MANET protocols have given importance on establishing significant interactions among various layers of the network stack to enhance network performance. This CLD approach that, introduces stack wide layer interdependencies is beneficial in dynamic environments of MANETs. The CLD approach makes use of the current state information available throughout the network stack to develop adaptive protocols. The purpose of CLD is to connect the resources of all communities together to make a network, which is highly adoptive to changing environment and allow sharing of the information between the individual modules in the system. Several functional requirements such as node mobility management, QoS awareness, node's cooperation, energy conservation and security aspects can be effectively implemented by exploiting and combining mechanisms of all the layers of the MANETs. A way to implement this requires removing the rigid layering in which each layer's protocols are developed in isolation. Approach now needs to use an integrated, intra-dependent and hierarchical framework setup to utilize the advantages of the interdependencies among layers.

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3. PROPOSED SYSTEM

There are four different approaches in the CLD they are: creation of new interface, layer merging, design coupling and vertical calibration. The CLD architecture follows three implementations such as: direct communication between layers, a shared database between layers and a completely new abstraction approach. A set of precautionary measures of CLD should be followed while its implementation. A typical example of CLD approach that jointly optimizes transmission rate, transmission powers, scheduling (a function of medium access) and routing has a goal of achieving proportional fairness.

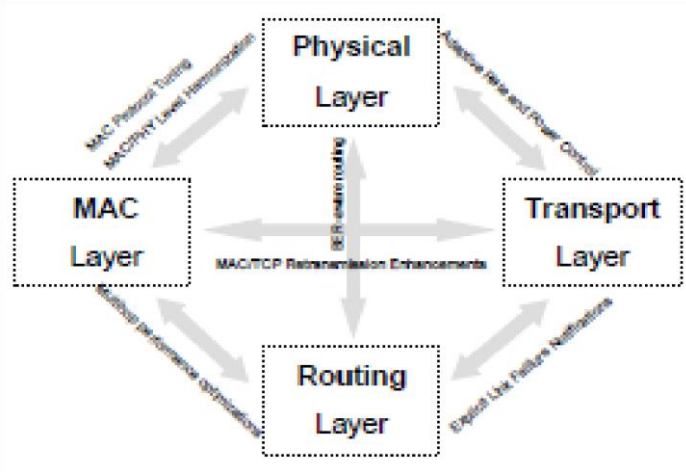

Fig.2. Approach System

In the networks that are developed on physical layers wherein a transmission rate is directly proportional to Signal to Noise Ratio (SNR) at the destination (example include low-gain CDMA systems or UWB). Lower and upper power limits are (0 − PMAX power control): i.e. node should either transmit with Max power or should remain silent. The level of interference at the receiver is used to vary transmission rate at the sender due to availability of several senders sending simultaneously. Modularity is attractive feature of Open System Interconnect (OSI) model, these modules have ability to operate under worst condition scenario and communicate in a strict manner using interface called Service Access Port (SAP). The SAP is the means to use well defined function(s) offered by protocol layer via primitive operational methods. The two layers that want to interact may use multiple SAPs based on its intended functions and the information requirement The resulting software from strict layering can be inefficient in terms of spectrum utilization and energy usage. If layers are designed using cross layer architecture having ability to observe and respond to channel conditions, dramatic improvement in efficiency can be achieved. CLD approaches are considered as inevitable to support many new processes requirements beyond third generation (3G) mobile communication network applications. using propagation model authors have illustrated the negative effects of path loss and shadowing by producing results that are obtained with simple error free model and communication model added with path loss and shadowing. Drastic difference obtained concludes that available state of the channel and the link quality are important factors that affect route discovery and hence hop-count is treated as non-optimal metrics. The wide diffusion of cross layer interaction proposals in applications of MANETs indicates the popularity of CLD in the research community. The basic questions in CLD approach are: which layers of the standard reference architecture are considered for cross layer interaction? And how to implement intended interaction between identified layers of standard reference? The reasons for asking these

questions are: a comprehensive analysis indicating the benefits and drawbacks that suggest the complexity and achievable performance enhancement are not available. Another issue in CLD approach is to how cross layer interaction based architecture and traditional layered model based architecture can coexist with one another. The existing methods for cross layer optimization are normally based on joint solutions which considers three bottom layers of standard ISO reference protocol suite. The specific traits of MANET's pose challenges to network protocol design of its layers. The lowest layer called physical layer must concern with instantaneous changes in the link features. The media access control (MAC) layer that handle fair channel access, packet collision conditions has to deal with hidden node and/or exposed node problems. Node cooperation to discover and maintain optimal path is required at network layer. The transport layer need to be capable of handling loss of packets and delay feature that sounds different from wired networks counter parts. Various possible disconnections and reconnections are taken care in application layer. Moreover, developments of all network protocols need to interface smoothly with traditional network architecture to consider possible security issues and QoS needs. Most of protocols proposed for MANETs assume layered architecture design which is highly rigid or strict and each layer specific protocol architecture is only concentrated about the interface to neighboring layers. In recent years, due to availability of several enabling technologies the MANET protocols have given importance on establishing significant interactions among various layers of the network stack to enhance network performance.

CONCLUSION

In view of future applications, this paper explores the motivations of CLD approach in the context of MANETs. The Investigation of some cross layer optimizations reveals that, CLD enabled MANETs has benefit of designing protocols that are able to adapt as per network conditions and support application with seamless ubiquitous access to distributed resources and service requirements. The protocol's adaptation and mutual cooperation across the layers results in MANET communication that can effectively meet the challenges to be confronted by future applications during coming years.

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