

SDN based Multi Path Routing for Efficient Cost Minimization - Advanced Networking Algorithm

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ABSTRACT: Software Defined Networking (SDN) is introduced to improve network programmability, simplify network management and enhance network operation. It is a paradigm shift in networking that suggests to decouple the control plane from the data plane and place the control of the system in a logically centralized node called ‘SDN controller’. The existing system, examine the problem where the optimality gap of iterative routing algorithms decreases exponentially fast and we want to minimize the average routing cost subject to a constraint for the average reconfiguration frequency. Furthermore, we present two control policies working on top of the online routing optimization engine to decide whether to apply or not the current yet not optimal global network configuration. Numerical results on the GEANT network and fat-tree network topologies show that our control schemes can effectively track the evolution of the system using a bounded number of reconfigurations, thus pursuing the double objective of optimizing the performance and his system stability. The recent technology on routing has given many solutions that it is carried out to many SDN networks, solving online versions of the problem with computing consistent flow migration. This thesis presents an autonomous network reconfiguration system (ARS) that enables a SDN to autonomously recover from local link failures to preserve network performance. By using ARS generates necessary changes in routing and algorithm with channel assignments in order to recover from failures.

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1.INTRODUCTION

BIRTH OF SDN

6WIND's items are firmly identified with what is called Software Defined Networking, it sounded good to me to begin with some essential ideas about this subject. Some after articles should center around my work on BEBA, an European research venture that goes for making programmable switches "quicker and more brilliant". In any case, you may ponder: what do I mean by "programmable" switches? This is exactly one of the inquiries to which you will discover an answer in this article: here we will perceive how organizing has developed throughout the most recent years to wind up (even) more mind boggling, with PCs or switches no all the more being delimited by their equipment.

Physical connection with wires

Actually, correctly setting up a network is way more complicated than that. This is why so many protocols have been invented and implemented over the years: making it run, and addressing the requirements in terms of stability, scalability, security, quality of service and so on... it could require quite a lot of skills and knowledge from the administrator. Nevertheless, it would come down to connecting different physical hosts together. Even since wireless networks have been deployed, this has remained a basic principle.

VIRTUALIZATION

Virtualizing hardware isn't something new; it was being used back in the 1960s to isolate the framework assets given by centralized server PCs between various applications. In any case, it has advanced a considerable measure with the years. As equipment assets turned out to be more reasonable and PCs all the more intense in the 2000s, it wound up conceivable to imitate whole working frameworks alongside their work area applications.

- The quick deployment is enabled with the reproductive builds (At every instance it is easier to reproduce the emulated environment than it would be on different physical hosts with distinct hardware).
- If the virtual applications running over a physical machine are high demanding in resources, when it is more scalable and very "agile", some of them may be moved from one physical host another. For the entire running physical host, an optimal consumption of resources is ensured by this process.
- Regarding security, it is usually interesting to isolate sensitive applications inside a system that has no access to other sensitive data, and that can be reinitialized easily.

As a generic principle, the data plane must be very fast to handle a very high number of packets with simple rules so as to obtain a good bit rate in the network. By contrast, the control plane is slower. For legacy switches, the whole control and data planes would be tightly linked into a same hardware box. They

would not be clearly delimited, and the switch would usually present a single setup interface. But virtual switches offer new possibilities: they make it doable to *centralize* the management of the switches and to remotely program them. The control plane is organized in such a way that switches take orders from a centralized controller in the network. This controller dynamically installs packet processing rules onto the switches, and receives and (slowly) handles exception packets when needed.

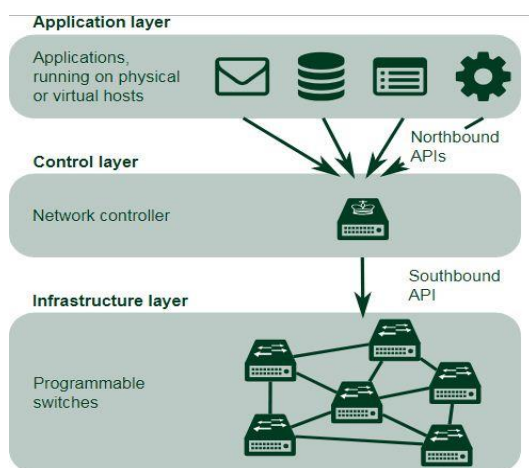


Fig 1.1. SDN Architecture

If the controller is to be represented at the center of a diagram, it is attached to network-requiring applications on top by so-called *northbound APIs*, while it is linked to the data plane below by what are called *southbound APIs*, used both to set up the switches configuration and to handle the exceptions packets.

So this is what SDN looks like! Or what it used to be in the first years. In

fact, the distinction between control and data plane should be considered as an “implementation choice” of SDN and not as a definition of SDN by itself. And as technology evolves, so does the architecture. Now the switching equipments often include separated components, thus creating architecture with three levels:

- “Control-management” plane is where the administration takes place; this is the controller configuring the remote switches.
- “Control-plane APIs” of a programmable switch can be used to form a component that both receives setup instructions from the controller, *and* is able to somewhat perform simple updates of the data plane without always referring to the controller.
- Data plane, as before, handles fast packet processing.

2. RELATED WORK

Several coverage algorithms have been proposed in the recent past[2]. The way nodes are deployed in a SDN has a major effect on coverage. Numerous papers surveyed about diverse coverage algorithms based on the deployment of nodes. Shibo Lai and Balogh (2004) have considered three types of deployments for a sensor network on a unit square ie $\sqrt{n} \times \sqrt{n}$ grid, random uniform (for all n points), and poisson (with density n). In all three deployments, each sensor is active with probability p , independently from the others. Then, they claimed that the critical value of the function is 1 for the k -coverage event of every point. They also offered an upper bound on the window of the phase transition. Even though the conditions for the three

deployments are identical, they achieved sharper bounds for the random deployments than the grid deployment, which happens due to the boundary condition. They provided improvements to formerly published results for the grid deployment model. At last, they employed simulation to demonstrate the value of their investigation in actual deployment scenarios.

One of the main applications of SDN is to offer proper coverage of their deployment regions. A SDN k -cover its routing region if each point in its deployment region is within the coverage ranges of as a minimum of k nodes.

Wan and Yi (2006)[4] have assumed that the nodes are deployed as either a poisson point method or a uniform point method in a square or disk region, and revised how the probability of the k -coverage varies with the sensing radius or the number of sensors. Their results considered the complex boundary effect, rather than evading it by imagining the toroidal metric. The deployment of nodes is one of the most basic and main issues in SDN, and coverage is a principal concern in deployment requirements.

Sung and Yang (2010) [8] have proposed a hexagonal cell-based sensor deployment approach that implements a mobility-assisted hybrid wireless sensor network. Calculation of coverage hole size, the equivalent hole-healing process and discovery of almost redundant sensors are based on the hexagonal cells into which the sensing field was virtually divided. Their simulations showed that the proposed algorithm attained considerably improved field coverage, and specified both the number and the authority of nearly redundant sensors in the wireless sensor network. Spatial

query execution is a fundamental functionality of a sensor network, where a query collects sensor data within a particular geographic region. Redundancy within a sensor network can be developed to decrease the communication cost incurred in execution of such queries. Any reduction in communication cost would effect in an efficient use of the battery energy, which is very limited in sensors[6]. One scheme to decrease the query's communication cost is to self-organize the network, in response to a query, into a topology that engages only a small subset of the sensors adequate to process the query. The query is then executed by means of only the sensors in the constructed topology. The self-organization method is valuable for queries that run adequately long to pay back the communication cost incurred in self-organization.

Cardei and Du (2005) employed a central data collector node to collect information from the other sensor nodes to make a decision which sensors to put into sleep mode.

Gallais et al (2008) have proposed numerous localized or distributed nodes area coverage protocols, for random ratio of sensing and transmission radii. Sensors were assumed to be time synchronized, and active nodes were found out at the starting of each round. The scheme has a very little communication overhead as earlier knowledge about neighbor existence is not needed. Each node chooses an arbitrary timeout and listens to messages sent by other nodes prior to the timeout expires. SDN nodes whose sensing area is not fully covered (or fully covered but with a disconnected set of active nodes) when the deadline expires choose to remain active for the believed

round, and transmit a message announcing their movement position. There were four variants in their approach, depending on whether or not negative and retreat messages were transmitted. Empirical results with ideal MAC layer showed that, for a complimentary number of chosen active nodes, their techniques considerably reduced number of messages to come to a decision activity compared to their existing localized protocol, they also considered a MAC layer with knock, and revealed that existing compared method, for dense networks, failed to cover the area logically. Their methods, though, stay robust in terms of high area coverage with reasonable quantity of active nodes, in spite of a few message collisions.

Chen et al (2007)[11] have developed a localized algorithm for barrier coverage. Although individual nodes cannot confirm the lack of barrier coverage in a network, centralized algorithms for barrier coverage do not scale well. The need for a distributed algorithm is apparent so they introduced the Localized Barrier Coverage Protocol (LBCP) which is intended to maximize the network lifetime by determining when nodes should be put into sleep mode and woken back up. The authors' simulations showed that LBCP provides near optimal performance while providing barrier coverage most of the time. The protocol breaks down as the width of the barrier increases.

Liu et al (2008) have presented an entire solution to the crisis for nodes that were distributed according to a poisson point process. In exact, they offered an efficient distributed algorithm to construct node barriers on long strip areas of irregular shape without any constraint on crossing paths.

Alternatively, if $w=O(\log l)$, then with high probability there is a crossing path uncovered by a few node despite of the node density. They then devised, based on the result, an efficient distributed algorithm to construct numerous disjoint barriers in a large node network to cover a long boundary area of an irregular shape. Their algorithm estimated the area by dividing it into horizontal rectangular segments interleaved by vertical thin strips. Each segment and vertical strip independently computes the barriers in its own area, they had achieved continuous barrier coverage for the entire region mechanism "horizontal" barriers in each segment connected by "vertical" barricade in neighboring vertical strips,. Their scheme considerably diminished delay, communication overhead, and computation costs compared to centralized techniques. Finally, they had implemented their algorithm and carries out a number of experiments to show the effectiveness of constructing barrier coverage.

4. PROPOSED METHODOLOGY

HAMMING CODING

Single-bit error correction

Concept of error-correction can be easily understood by examining the simplest case of single-bit errors. As we have already seen that a single-bit error can be detected by addition of a parity bit (VRC) with the data, which needed to be send.

A single additional bit can detect error, but it's not sufficient enough to correct that error too. For correcting an error one has to know the exact position of error, i.e. exactly which bit is in error (to locate the invalid bits). For example,

to correct a single-bit error in an ASCII character, the error correction must determine which one of the seven bits is in error. To this, we have to add some additional redundant bits.

To calculate the numbers of redundant bits (r) required to correct d data bits, let us find out the relationship between the two. So we have $(d+r)$ as the total number of bits, which are to be transmitted; then r must be able to indicate at least $d+r+1$ different values. Of these, one value means no error, and remaining $d+r$ values indicate error location of error in each of $d+r$ locations. So, $d+r+1$ states must be distinguishable by r bits, and r bits can indicate 2^r states. Hence, 2^r must be greater than $d+r+1$.

$$2^r \geq d+r+1$$

The value of r must be determined by putting in the value of d in the relation. For example, if d is 7, then the smallest value of r that satisfies the above relation is 4. So the total bits, which are to be transmitted is 11 bits ($d+r = 7+4 = 11$). Now let us examine how we can manipulate these bits to discover which bit is in error. A technique developed by R.W. Hamming provides a practical solution. The solution or coding scheme he developed is commonly known as Hamming Code. Hamming code can be applied to data units of any length and uses the relationship between the data bits and redundant bits as discussed.

BIT-BASED PACKET COMBINATION

The adaptive algorithm performs very close to optimally with a history of just 10,000 bits. We notice that when the bit-error-rate is very low or very high the adaptive system performs slightly worse than optimal. While when the error-rate

is in the “middle range” the performance of the algorithm is nearly optimal. We attribute this difference at the very low error rate to the fact that at such error-rates it is difficult to make a reliable estimate of the error-rate with just 10,000 or even 100,000 bits of observation. At the high error-rate range the difficulty in making a reliable estimate is that packets are too large to make such an “unbiased” estimate. This is because every packet contains 40 bits of header information and so a packet cannot be made smaller than 50 bits. Nonetheless, we see that the system performs very well even in the absence of very good bit-error-rate estimates at the high and low error-rate ranges. This is because the performance of the algorithm in these ranges is not very sensitive to the choice of packet size. For example, the optimal packet size with an error-rate of 10^{-5} is 2000 bits while with a rate of 10^{-6} it is about 6000 bits. However, when a 2000 bit packet is used with an error-rate of 10^{-6} the resulting efficiency is still better than 98%. Consequently, it is not necessary to obtain a very good estimate of the error-rate but rather it is sufficient to establish that the error-rate is in the low range or the high range.

A novel Multiple-path FEC approach (M-FEC) based on Hamming Coding is proposed for improving reliability and energy efficiency in SDN. The 7-4 Hamming Coding FEC approach is adopted for encoding packets in the source nodes and for decoding the received information in the intermediate nodes and destination nodes.

The comparison of the overall PER between multiple-path communications and single-path

communications is presented. A dynamical Decision and Feedback scheme is designed in the destination node for M-FEC to decrease the number of the paths in order to save energy and ensure the desirable PER.

FEC based on the Hamming Coding scheme is a useful approach to improving BER. Furthermore, the crucial performance in terms of energy efficiency is taken into account for designing SDN. However, energy efficiency and delay are paradox typically in wireless networks. To bridge this gap, a widely used scheme, energy-efficient multi-path communication has been proposed to eliminate retransmission and reduce delay. In addition, the cost of all paths is calculated and lower cost paths are selected for communication.

5. RESULTS AND DISCUSSION

Our proposed protocol is also proved by evaluating the residual energy in each node for a particular rounds of simulation. It is also observed that a larger variance value indicate how dispersed the residual energy of all node is from the mean value after the entire simulation rounds. It is also noticed that as the value of the variance gets closer to the mean value, it implies a better performance of network since most of the node will die almost at the same time in the end of the simulation.

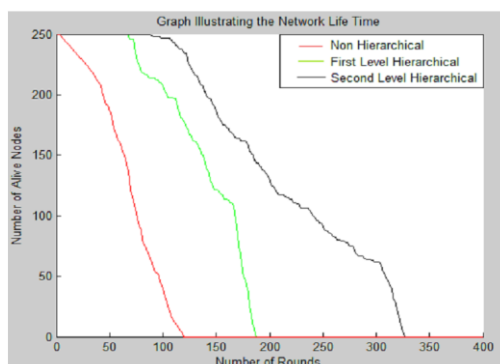
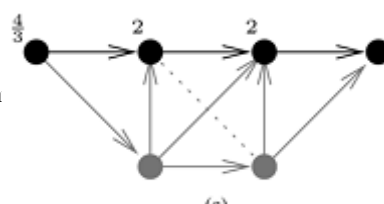
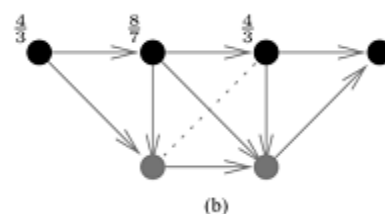
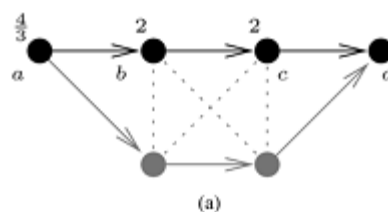


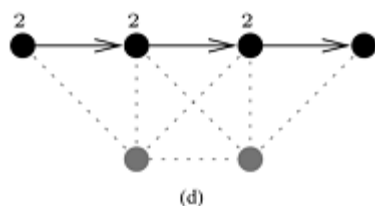
Figure 5.1. Lifetime of nodes

Since the sensor nodes in each cluster send data to the cluster head within its cluster range and then the aggregated data is sent to the cluster head closer to the base station, which further aggregates data of its own cluster and that of the incoming data, from cluster head whose distance is farther to the BS, before sending the data to the base station.

A Network route T is a Multipath Routing R in a Subgraph of G it connect from source to destination that is S and N . The network path that may simple of all other results that could occur with in duplicate transmission of nodes from one packet to another packet receiver. The total cost of trajectory is very defined with in anypath route which it has been traverses.



Standard Interna



Cost of the routing path is $T = \{a, b, c, d\}$ traverse from many different paths. The cost of route d_{ij}^{path} is given to next another nodes of consecutive which is

- $c(T | R) = 5.33$
- $c(T | R) = 3.81$
- $c(T | R) = 5.33$
- $c(T | R) = 6$

6. CONCLUSION

The research projected an enhanced Forward Error Correction approach that is Enhanced FEC, designed with Hamming Coding for multiple-path communications in Underwater Sensor Networks. To the most excellent of the knowledge, this is the first of its kind on segment-based packet combination and recovery technology for forward error correction with Hamming Coding which can get better both energy efficiency and dependability in SDN. In our research we used enhanced Forward Error Correction integrates multi path infrastructure and Hamming Coding to

eradicate retransmission and enhance reliability. To reduce the consumed energy of broadcast, the new model is used to calculate the overall packets send in order to make a decision for the number of multiple paths guaranteeing the desirable packets. The proposed approach can significantly outperform conventional multiple-path communications and single-path communications in terms of an energy efficiency and reliability. The sketch based system follows the each and every goal to use of lessen energy use that enhances the latency of communication in scalability and robustness, thus the flooding are techniques in networks that is to tolerate and end-to-end delay using low processing overhead.

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