Privacy Preserving Throughput and Packet Classification for Network Efficiency

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***Abstract*— Packet classification is one of thecorefunctions for performing efficientnetworkingfunctionalities in network infrastructure. Most ofthepacket classification algorithms are baseduponrulesets[14]. Rulesets must be independent in orderto provide high throughput and low latencyduringpacket classification. If the rulesets featuresaredependent it affects the performance of thenetwork.In order to avoid these problems we proposedapacket classification technique which isrulesetindependent, and also provides routing andsecurityfunctionalities. StrideBV algorithm is usedforefficient packet classification [15] and weincorporatea bio-inspired algorithm called ACO forfindingshortest path[13], to avoid congestion in the network. The transmitting packet is securedusingHMAC algorithm [7]. The main aim is tomaintainmaximum lifetime of the network by increasingthethroughput and avoid network congestionandminimized consumption ofenergy**

Keywords: Packet classification, networksecurity,ACO, HMAC, packet latency,throughput.

I. INTRODUCTION

Secure networking becomes more crucial due tovarious attacks on networks. To protectnetworksfrom attacks various software tools andequipmentswere used. Packet classification is one of theprocessused as the initial filter for classifying networktrafficinto flows based upon rulesets. Rulesets inspectsthefields in packet header which compare the sourceIPaddress with destination IP address. Themainproblem with the hardware is that,packetclassification engines require more space to store the rulesets. To achieve this various techniqueshavebeen proposed but most of the techniquesdon'tprovide efficient memory management. Forhigh-speed networking throughput and Quality ofServiceare the basic requirements. To provide bothmemoryefficiency and high throughput in the same solutionisdifficult due to many reasons. Hence in this workwemainly concentrate on improving throughput andnotmainly concern about memory efficiency. Wepresenta packet classification scheme called StrideBVwhichtend to yield high throughput which is baseduponfield split algorithm. Using hardware chip FPGAwecompare the performance of proposed withtheexisting work. We have inferred the ACOtechniqueto different network models with various numberofnodes and different structure to obtain theoptimumthroughput and to find out the shortest path.Variousexperiments have been carried out by differingtheloads of the network. Here the networkperformancefactor is taken by the reliability and throughput ofthenetwork. Even though the packets areclassifiedefficiently, security issues should also be takeninconcern. To increase the life time of the network,data has to be transmitted safely. In order toprovidesecurity to the network HMAC algorithm isused.

To summarize, we subsidize our work asfollows:

- Packet classification is performed usingstrideBV method, which isrulesetindependent.
- To find the optimal path ACO algorithmisincorporated to increase the throughputofthenetwork.

- For secure data transfer HMACalgorithmhas been used for increasing life span ofthenetwork.

II. RELATEDWORK

Many packet classification algorithms havebeenintroducedinthepastdecadecanbefoundin[14].Modular bit vector architecture for efficientpacketclassification was presented by ThilanGanegedara,Viktor K. Prasanna called strideBV which isrulesetindependent. The performance analysis oftheproposed system is based on differentconfigurations.FPGA has been used for packet classificationinearlier stages which achieves 100G+ throughputonclassifying a packet. But the proposed work is thefirst classification engine which yields400G+throughput, which is comparatively moreefficientthan all existing work[5]. Throughput of thenetworkgradually decreases as the ruleset sizeincreases.Hence ruleset independent features are adoptedforbetter throughput. In this proposed work rulesarerepresented as ternary string. For moreefficiencyrange-to-prefix conversion has to befollowed.

By experimenting various ant colonyoptimizationstechniques by Debasmita Mukherjee andSriyankarAcharyya they proposed various antcolonytechniques called ACO1, ACO2 and ACO3 hasbeenproposed and applied on various networkstandardsand models. They compared the performance ofeachalgorithm and a tabular list is maintained andiscollected to find the optimum solution. In theirworkreliability and throughput of the network isconsideras the major performancefactor.

The security is considered as the major issueinevaluating the performance of the network.Manytechniques has been introduced in the pastdecadeand one of the most efficient technique is that HMACwhich ensure message authentication andsecurity.The technique is proposed by Marcio JuliatoandCatherine Gebotys in which FPGA basedHMACtechnique is proposed and presented in thispaper.The proposed system can attain 1.5Gbpsthroughput.The energy consumption is found to be better bythisproposed method. These methods are used toprovidehigher security levels for both mobile devicesandservers which manage memory and speedefficiently.

III. EXISTINGSYSTEM

In existing system a novel modularBit-Vectorarchitecture is proposed using range–to-prefixconversion which yields poormemoryefficiency[9][3]. And in this work themaindisadvantages are considered to be securityandenergy efficiency. Accuracy and security is verylowin this network. Latency rate can be highwhenapplying this technique to the larger network.Thedata that are transferred in this network is copiedorhacked by some other network because ofpoorprivacy of the network. This affects the lifetimeandenergy efficiency of thenetwork

IV. PROPOSEDSYSTEM

Themainaimofourprojectistoimprovenetworklifetime by considering one of the basicnetworkparameters called packet classification.Packetclassification is done by FPGA basedstrideBVtechnique[6] which uses pipeline architectureforclassifying the packets. Secondly the shortestandefficient path for transferring the packet isdetermined using ACO technique. Finally data inthenetwork is secured using HMACalgorithm.

1. *Packet classification using strideBVmethod:*

The input packet header contains cbitswhich are matched to c bits of x bit rulewhichperform matching process independently.Wecan divide the x bit rule into x/c of c bitsubfields.Inputheaderismatchedwithxbitrule,everycbitoftheinputpacketismatchedwithcorresponding memory whose depth is 2^c.theinput packet is undergo bitwise AND operationin a pipelined fashion and find the matchingwiththe entireclassifiers.

Algorithm1:

Packet ClassificationProcess.

Require: A x-bit packet header: $P_{x-1}P_{x-1}\ldots.P_0$.

Require: 2k *x/c, Nbit-vectors:

$A_{i,j} = B_{i,j,N-1}B_{i,j,N-2}B_{i,j,0}$,

$i = 0,1,\ldots;x/c-1$, and $j =0, 1,\ldots,2c-1$

Require: A N bit-vector Am toindicatematchresult

```
Ensure: N bit-vector Am
indicatesallmatchresults

 1: Initialize Am: Am< -11….1
Allrulesmatchinitially

2: for i<-0 to X=X/C-1 {bit-

 wiseAND}3: j = [Pi*C: P(i+1)*C]

4: Am <-AmAi,j

5: endfor
```

***2.** Finding shortest path using ACO*

We have inferred the ant colonyoptimization technique to different networkmodelswith various numbers of node and differentstructureto obtain the optimum throughput and to find outtheshortest path. Various experiments has beencarriedout by differing the load of the network. Herethenetwork performance factor is taken by thereliabilityand the throughput of the network. Routingprotocolsare used to calcuate, choose and selecttheappropriate path in order to transfer the packetfromsource to destination more efficiently. Thereexistsmorenumberofroutingalgorithmsinordertofind the shortest path and thus to increase thenetworkthroughput. this is a routing algorithm proposedandapplied to big network structure with the heavyload.this algorithm selects the path of datapacketprobably guided by the shortest path. The aim ofallnetwork routing algorithms is to reducethecongestion during packet transfer from sourcetodestination thereby maximizing the performance ofnetwork. The performance could be measured by the throughput (i.e. the number of bits delivered perunittime) and the amount of data packets reached atthedestination i.e. the reliability of the network. theantsselects the nodes randomly at the initial statebygetting the information from the routing table.Theants which have successfully reached thedestinationupdates the pheromone secretion at the edgesvisited.

```
Algorithm 2:Finding
shortestpathProcedure ACO
(source,destination)
{

assign initial positions  to a set the
packetsatthe  given source;  while(source
!=destination)

{

callfindnextnode(source);

  set newsource =
 selectednode;source
 =newsource;
}

update the pheromone table using
thepathsselected by the successful packets;
send anextset of packets guided by the
information leftbyall the previous
visitorpackets;

}

Procedurefindnextnode(source)

 {

Check the routing table
entriescorrespondingto the source if a link
exists with thesource

 {

    If (the node is alreadyvisited)

{

         Cancel thenode;

    Else if (the node not already visited){

         Mark the node as eligible
ofbeingselection

      }

 }

 Using the pheromone information,
selectanode from the list of eligible nodes;
returntheselectednode;
}

}
```

3. Ensuring security usingHMAC:

The main reason for choosing the HMACalgorithmis that, we can use the hash functionswithoutmodifications. The hash function for HMAC codeisfreely and widely available. The maindisadvantageof HMAC algorithm is that we can use andhandlekeys in a very simpleway.

the XOR with *opad* results in flipping one-half ofthebits of *m.* Similarly, the XOR with *opad* resultsinflippingone-halfofthebitsof*m*,butadifferentsetof bits. In effect, by passing l_i and l_o throughthecompression function of the hash algorithm, youhavepseudo randomly generated two keys from *m*.HMACshould execute in approximately the same time astheembedded hash function for long messages.HMACadds three executions of the hashcompressionfunction (for m_i, m_o, and the block produced fromtheinnerhash).

3. The HMACalgorithm

1. Append zeros to the left end of *m*tocreate a *b*-bit string m^+ (for example, if*m*is of length 160 bits and $b = 512$, then*m*will be appended with 44 zerobytes0x00).

2. XOR (bitwise exclusive OR) $m^+$with *ipad* to produce the *b*-bit blockl_i.

3. Append *M* tol_i.

4. Apply *H* to the stream generated inStep3.

5. XOR m^+ with *opad* to produce the*b*-bitblockl_o.

6. Append the hash result from Step 4to l_o.

7. Apply *H* to the stream generated inStep6 and output theresult.

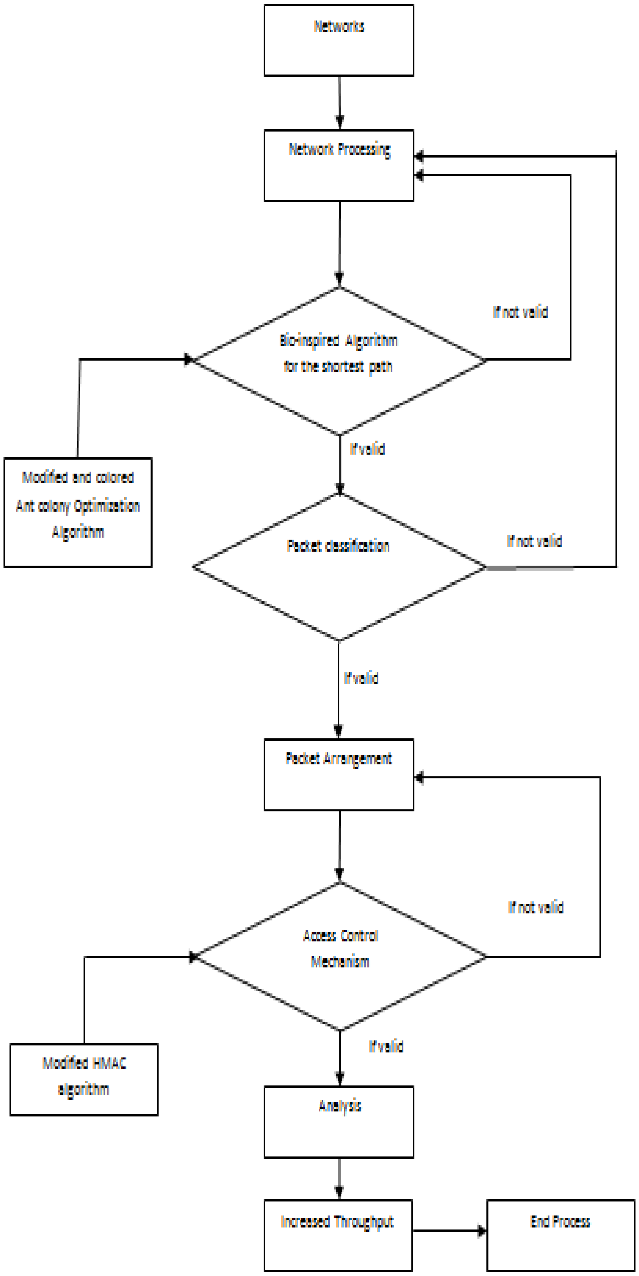

Fig: overall architecture of theprocess

V.CONCLUSION

We have conferred the modular architecture forhighspeed packet classification by using thefieldprogrammable gate array (FPGA). The throughputhas been increased with the help ofpipelinedarchitecture but the memory efficiency has notbeenconcentratedandwhichhastobeemployedinthefuture. Thedatacontrolisthemajorlyfocusedandimplemented criteria of this paper. Access controlisnot contemplated in our work. The clusteringconceptcan be utilized for achieving the access control.Inourworkwehaveprovidedthebettersecuritywiththeassistofhmacalgorithm.Theoptimalpathisconstructed using the dynamic algorithm andtherebyincreasing the throughput of thenetwork.

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