Predictability And Scalability in Heterogeneous Network For Emergency Management System

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ABSTRACT

With increasing vulnerability and intensity of weather extremes, anticipation of severe events is a fundamental element to protect the society by reducing the socioeconomic damage effectively. The objective of this paper is to propose the networking model for the emergency management system using heterogeneous networks to predict and prevent the floods. The study of prediction of flood includes the various input parameters such as soil moisture, air pressure, direction of wind and seasons. The model is designed in an approach that the system can accept different types of requests of different formats through various sub-networks virtual. The arrangement is equipped to accept the surplus networks to the existing network with the routing policies been opted to meet the major concerns over the networks to meet the service parameter.

Keywords : Heterogenous Networks, Parameters,Socio-economic, Sub-networks

1. INTRODUCTION

To meet the unpredictable disturbances, satellites are being used to capture images, videos for various purposes like observing the earth, weather data, live images for cyclones, tsunami, floods, earthquake e.t.c and this data can be accessed through internet by terrestrial user. The mobility protocol provides the uninterrupted real-time data communication through the networks in motion, aircraft, and satellites. In order to cope with natural or man-made calamities, an emergency management system to handle such situation needs to be highly available with scalability and portability of subsystems. The correctness and predictive of the information prioritize the response and focuses on the activities that have the highest potential to save the life and property. This requires system which is made of heterogeneous communication and computing networking to understand and proclaim the disaster. Yet with many number of constraints and conflict the network adopts the policies as packet storing, forwarding and routing to enhance the survivability of emergency services networks. This system should support flexible and adaptive communication subsystems which can adopt themselves by balancing load even if a huge traffic in the network is established through network virtualization. An effective emergency service can be achieved only through the network of national center or government agencies from different services work with coordination and cooperate together and have openness in communication. Emergency management is a multi-disciplinary, multi-organizational, organizes the resources, technology, equipment and funds.

The tremendous growth in the technology with the multimedia data networks, the satellite communication with huge range of activities, service provider organizations tend to be conservative about introducing the new technology into satellites. The development of new technologies and their deployment would still redefine the satellite communication leadership for yet another 3-5 years which in turn would be source for the networking. Globalization and deregulation have allowed terrestrial carriers to more closely cuddle satellites technology. The satellite communication have come to rescue where the total collapse of network occurs or poor network in the calamity area be it on high/low mountains or in the bad weathers e.t.c This paper focuses on a) the designing of the algorithm to perform the diverse activities and b) the designing the model and simulate on the request based.

2. COMMUNICATION OVER THE DIFFERENT SERVICES

An adequate preparation before the disaster would strike includes evacuations of human lives and other creatures, with the current data and identifying the linking data resources for seamless access to the network during an emergency. The critical phase of a disaster action required for minimizing damage or saving lives should be performed by closing safety values, controlled power down of electrical systems, automatic opening or closing of emergency doors and so on. The integrated disaster management system must learn to provide relevant data for pre-disaster and post-disaster lessons for training purpose.

Extending the scope of study on emergency management system, before the terrorist attacks, fire, floods, earthquake were considered to have high priority with a technological focusing on local and mobile communication centers, simulation and training whereas anti-terror efforts were given maximum priority adding cyber security, authentication , image processing ,sensors and training to the technological focus area.

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The system involves various phases like preparedness before the occurrence, mitigation, response to request and recovery.

The preparedness involves the coordination and communication between the fire, police, health, transport and all the other services. The headquarter (HQ) buildings are connected with each other and with government authorities are connected with network virtualization as figure 1.

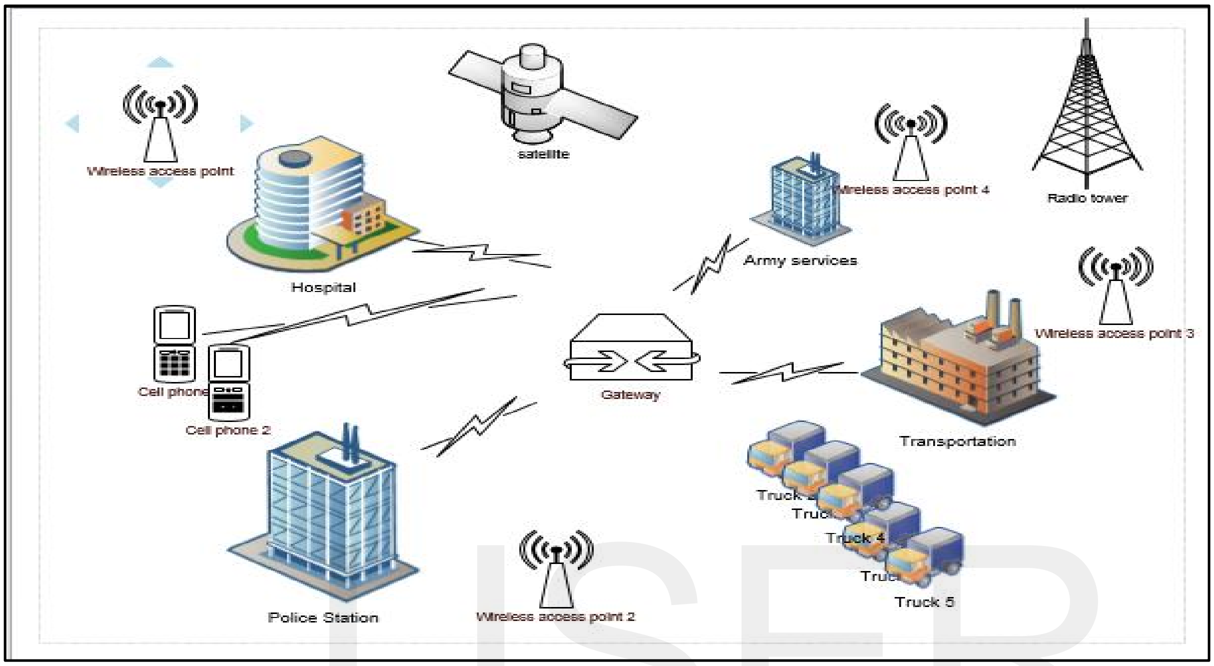

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Fig.1 Emergency management network model using scalable virtual multimedia data network

The fact that the prioritization method depends on selecting correct and right opinion at right time with rescue team size, coordination , communication and portable among the various networks involved and most of all the cooperation among the (HQ) services even at peak time.

The data is transmitted over a VPN, a secure transmission takes place and communication for different service sub networks is through IP gateway.

3. The Emergency Model

The model is used to indicate the details of the recovery process involved and resources utilized which helps in better preparedness for the forthcoming. The specification includes the nature, time of incident with the topographical location, calculating the severity and prioritizing it. The requirements for the vehicle used in the rescue operation are to be mentioned in the report beforehand.

The Key Process Activities (KPA) is tasks needed to carry out the emergency management services include

Phase 1: Receive –request calls from any mode through gateway
Calculate the number of request
Identify the source of request
Check the authentication for respective request
Clarify and get firsthand information
Classify the requests based on the mod

Phase 2: Analyze the category of emergency
Approve the estimated size of rescue force
Push it in into queue and store the details

Phase 3: Alert and Trigger the service force

Communicate to the supplementary task force
Maintain Log

Phase 4: Decide the rescue based on the severity, force, availability cooperation from people and task force at the incident spot
Define the size of needed task force to act on the area estimated

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Compute the time of deployment cost
Prioritizes and evaluations the time of completion
Monitor and manage the cost and time
Complete the recovery process
Report to the government authorities

4. CONTEXT AWARENESS COMPUTING IN FLOOD EMERGENCY SERVICE

In the network for emergency management system, a formal model of context awareness and adaptability is introduced [2]. The context awareness include three awareness: event awareness, service awareness and location awareness.Event awareness includes the request treated in different scenarios and depending on the priority the request is considered. In this proposed emergency management system for flood incident the request is made to be aware are considered.

Request 1:"evacuate, pre-signal received",
Request 2:"rescue, help building collapse",
Request 3:"help, washed away",
Request 4:"alert, epidemic"

Service awareness describes the type of services it can process and decide whether right decision is taken it involves the size and services are rendered on priority based. Here the nature of response for each request is processed.

Response 1: army
Response 2: police
Response 3: transport
Response 4: hospital

Location awareness includes the volume or size of the service forces be temporarily fixed based on request. The factor whether the communication can be reached at the crisis situation, how big the estimated disaster would occur, the effect of this calamity in and near- by places. The quantity of the requirement based upon the request received.

value (army and police) = "2 and 3" // 2 army services and 3 police services //
value (police and transport) = "2 and 4" // 2 police services and 4 transport services //

5. Calamity Handling Flood Incident (pseudo code)

The pseudo code is designed based on Bayes theorem to determine the severity and priority of the service activation according to the type and number of requests made and is developed using Microsoft Visio 2013 and Process simulator 32-bit version 9.2, a product of ProModel Simulation.

In figure 2, the flow of the model indicates that the incoming emergency signals/messages can be received from various networks with different data formats and then communicated to the concern location and preparedness measures are estimated. The different services are requested for the response to the crisis state. Depending upon the severity and the services are made available towards the expected volume and monitors the final deployment of the rescue units. The process thus helps in reducing the loss of human lives and destruction of property by sudden floods in any particular location.

```
#define F = {p-water, building collapse, washed-away, epidemic}
#define severity= {evacuate, rescue, help, safe, alert}
get request incident()
//request contains type of disaster,
// no. of victims involved, location, time
validate request();
//input through the signals through satellite network, virtual network
if F[i] = "p-water" && no_ of_ injuries>threshold[h] && no_of_requests>threshold[i]
then   severity="evacuate";
       priority="high";
call police[3];
call transport[3];
else
       severity="help";
       priority="low";
call police[1];
queue =queue-1;
GOTO next request;
If F[i]= "building-collapse" && amount-of-damage >threshold[h]
then  severity="rescue";
      priority="very high";
call police[4];
call army[4];
call transport[6];
else
          severity="help';
          priority="medium";
call police[3];
call transport[4];
queue=queue-1;
GOTO next request;
if F[i] = "washed away" && no_ of _injuries>threshold[h]
then      severity="help'';
          priority="low";
call army[3];
call transport[3];
```

```
else
flag=1
call service activation centre;
queue=queue-1;
GOTO next request;
if F[i]="epidemic"
then      severity="alert";
          priority="low";
flag=1;
call media send alert;
return
```

Fig 2. Pseudo code for the services required while flood incident.

The figure 3 describes the services required during flood disaster and the various services depending upon the signal received and based on the priority value.

The details are passed for computing tasks to decide the severity and calculate the amount of service forces. The Key Performance Indicators (KPI) like waiting time, operation time, blocking time are computed in the entity summary table gives the overall total exits of the receiving signal after the simulation of the model , which is described in table 1.

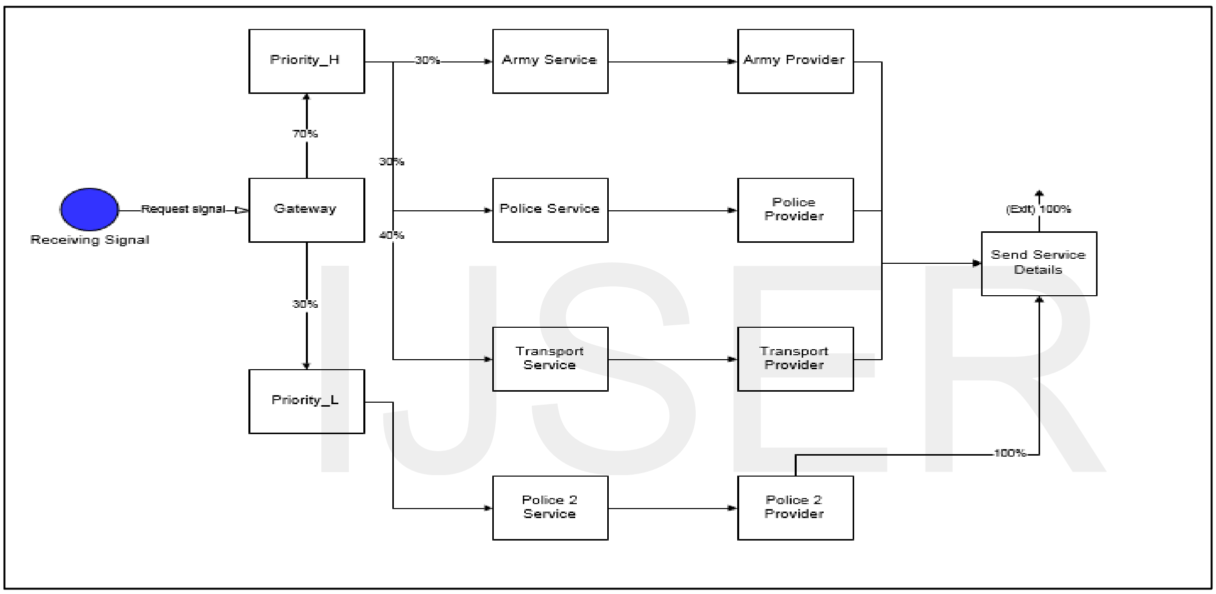

Fig 3. Proposed model for flood incident

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Table1 : Entity Summary

Name	Total Exits	Current Quantity In	Average Time In System(Min)	Average Time In Move Logic	Average Time Waiting(Min)	Average Time in Operation(Min)	Average Time Blocked(Min)

		System		(Min)			
Receiving Signal	164.00	47.00	130.50	4.87	0.00	35.26	90.37

The table 2 describes the activity states for multi capacity with the schedule time specified.The amount of the send service details input details is 61.90% empty with the gateway input 1.98% and priority is 50%.

Table 2 : Activity States (Multi Capacity)

Name	Scheduled Time (Hr)	% Empty	% Part Occupied	% Full	% Down
Gateway Input Buffer	17.65	1.98	98.02	0.00	0.00
Army1 Service Input Buffer	17.65	100.00	0.00	0.00	0.00
Police 1 Service Input Buffer	17.65	100.00	0.00	0.00	0.00
Transport 2 Service Input Buffer	17.65	99.84	0.16	0.00	0.00
Priority VH Input Buffer	17.65	97.90	2.10	0.00	0.00
Priority L Input Buffer	17.65	100.00	0.00	0.00	0.00
Army 2 Service Input Buffer	17.65	100.00	0.00	0.00	0.00
Army 1 Provider Input Buffer	17.65	99.81	0.19	0.00	0.00
Police 1 Provider Input Buffer	17.65	100.00	0.00	0.00	0.00
Transport 2 Provider Input Buffer	17.65	99.97	0.03	0.00	0.00
Army 2 Provider Input Buffer	17.65	100.00	0.00	0.00	0.00
Send Service Details Input Buffer	17.65	61.90	38.10	0.00	0.00
Washed Away Input Buffer	17.65	100.00	0.00	0.00	0.00
Priority H Input Buffer	17.65	97.68	2.32	0.00	0.00
Build Collapse Input Buffer	17.65	98.56	1.44	0.00	0.00
Priority M Input Buffer	17.65	99.97	0.03	0.00	0.00
Evacuate Input Buffer	17.65	99.60	0.40	0.00	0.00
Rescue Input Buffer	17.65	99.70	0.30	0.00	0.00
Epidemic Provider Input Buffer	17.65	100.00	0.00	0.00	0.00
Transport 4 Service Input Buffer	17.65	100.00	0.00	0.00	0.00
Transport 4 Provider Input Buffer	17.65	100.00	0.00	0.00	0.00
Media Input Buffer	17.65	100.00	0.00	0.00	0.00
Alert Messages Input Buffer	17.65	100.00	0.00	0.00	0.00
Police 2 Service Input Buffer	17.65	100.00	0.00	0.00	0.00
Transport 3 Service Input Buffer	17.65	100.00	0.00	0.00	0.00
Police 2 Provider Input Buffer	17.65	100.00	0.00	0.00	0.00
Transport 3 Provider Input Buffer	17.65	100.00	0.00	0.00	0.00

Police Service Input Buffer	17.65	99.84	0.16	0.00	0.00
Transport 1 Service Input Buffer	17.65	99.60	0.40	0.00	0.00

Table 3: Activity summary

Name	Scheduled Time (Hr)	Capacity	Total Entries	Average Time per Entity (min)	Average Contents	Max Contents	Current Contents	% Utilization
Gateway	17.65	1.00	173.00	6.09	1.00	1.00	1.00	99.53
Army1 Service	17.65	1.00	25.00	5.52	0.13	1.00	0.00	13.04
Police 1 Service	17.65	1.00	22.00	6.43	0.13	1.00	1.00	13.35
Transport 2 Service	17.65	1.00	26.00	6.26	0.15	1.00	0.00	15.87
Priority VH	17.65	1.00	74.00	6.18	0.43	1.00	1.00	43.22
Priority L	17.65	1.00	13.00	6.14	0.08	1.00	0.00	7.54
Army 2 Service	17.65	1.00	3.00	7.42	0.02	1.00	0.00	2.10
Army 1 Provider	17.65	1.00	25.00	5.88	0.14	1.00	1.00	13.88
Police 1 Provider	17.65	1.00	21.00	6.08	0.12	1.00	0.00	12.06
Transport 2 Provider	17.65	1.00	26.00	6.29	0.15	1.00	0.00	15.43
Army 2 Provider	17.65	1.00	3.00	5.10	0.01	1.00	0.00	1.45
Send Service Details	17.65	1.00	143.00	6.00	0.81	1.00	1.00	81.10
Washed Away	17.65	1.00	7.00	5.43	0.04	1.00	1.00	3.59
Priority H	17.65	1.00	51.00	6.38	0.31	1.00	0.00	30.72
Build Collapse	17.65	1.00	73.00	5.87	0.40	1.00	0.00	40.47
Priority M	17.65	1.00	34.00	5.70	0.18	1.00	0.00	18.29
Evacuate	17.65	1.00	51.00	5.87	0.28	1.00	0.00	28.29
Rescue	17.65	1.00	34.00	5.56	0.18	1.00	0.00	17.87
Epidemic Provider	17.65	1.00	6.00	5.08	0.03	1.00	0.00	2.88
Transport 4 Service	17.65	1.00	3.00	6.15	0.02	1.00	0.00	1.74
Transport 4 Provider	17.65	1.00	3.00	6.48	0.02	1.00	0.00	1.84
Media	17.65	1.00	6.00	6.00	0.03	1.00	0.00	3.40
Alert Messages	17.65	1.00	6.00	6.21	0.04	1.00	0.00	3.52
Police 2 Service	17.65	1.00	19.00	5.57	0.10	1.00	0.00	10.00
Transport 3 Service	17.65	1.00	15.00	5.78	0.08	1.00	0.00	8.19
Police 2 Provider	17.65	1.00	19.00	6.26	0.11	1.00	0.00	11.23
Transport 3 Provider	17.65	1.00	15.00	5.62	0.08	1.00	0.00	7.97
Police Service	17.65	1.00	29.00	6.25	0.17	1.00	0.00	17.13
Transport 1 Service	17.65	1.00	22.00	6.40	0.13	1.00	0.00	13.30

The computed values from the simulation are presented in activity summary of the table 3 which summarize that the total utilization of the washed_away and epidemic service provider are minimum where as the building_collapse service provider is shown maximum based on the receiving signal with priority. The figure 4 shows the partly occupied activities.

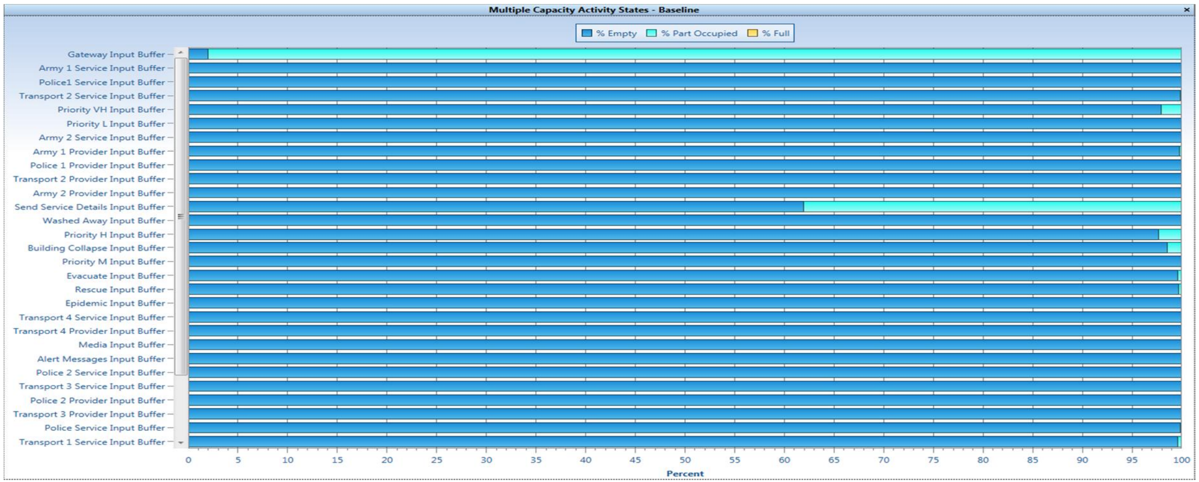

Figure 4: Multiple Capacity Activities States

CONCLUSION

It is possible to expand scalability, thereby reducing resource use, and support efficiently a heterogeneous multimedia data network by developing ways to specialize network services more precisely to application needs. The network synchronization across all the communication nodes is important. Finally it is concluded that pre and post disaster warning analysis tool can save the life of thousands of people before this critical condition of flood disaster occurs. The study reveals that whenever there will be earthquake inside the bed level of sea it provides a challenging opportunity for researchers to calculate the potential of floods in disaster hit region by the integration of underwater wireless sensor Networks. This helps in developing the preventive model for reducing the loss due to the flood disaster.

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