Journal of Theoretical and Applied Information Technology
10th March 2013. Vol. 49 No.1

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

MODELING OF COMPLEX SPATIO-TEMPORAL NETWORKS FOR IOT-CLOUD

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ABSTRACT

The article discusses the spatial temporal characteristics of the Internet of Things, makes a description and classification of IOT intelligent terminals and non-intelligent terminals. Supposes that as the cloud computing widely used, the IOT terminal entities will eventually connect with the computing entities, the final formobjects associated a IOT-cloud. Objects associated with IOT-cloud entities will have dual attributes of the Internet of Things and cloud computing. IOT itself have a complex social network characteristics and the complex computer network characteristics. The space-temporal network modeling process ues the complex sclae-free complex network modeling steps and describing method, the IOT-cloud secure access pattern use the cloud computing security mode. Distributed access control and quantify security decision-making process are made as an example to illustrate the correctness and practicality of the model.

Keywords: *IOT，Cloud Computing，Cloud Securety，Access Control，Scale-Free Networks, Complex Spatio-Temporal Network.*

1. INTRODUCTION

The Internet of Things (IoT) is a novel paradigm that is rapidly gaining ground in the scenario of modern wireless telecommunications. The basic idea of this concept is the pervasive presence around us of a variety of things or objects － such as Radio-Frequency IDentification (RFID) tags, sensors, actuators, mobile phones, etc. － which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals [1]. Unquestionably, the main strength of the IoT idea is the high impact it will have on several aspects of everyday-life and behavior of potential users. From the point of view of a private user, the most obvious effects of the IoT introduc tion will be visible in both working and domestic fields. In this context, domotics, assisted living, e-health, en hanced learning are only a few examples of possible appli cation scenarios in which the new paradigm will play a leading role in the near future. Similarly, from the perspective of business users, the most apparent consequences will be equally visible in fields such as, automation and industrial manufacturing, logistics, business/process management, intelligent transportation of people and goods.[2] Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics (On-demand self-service, Broad network access, Resource pooling, Rapid elasticity, Measured Service); three service models (Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS)); and, four deployment models

Manuscript received January 1, 2012; revised June 1, 2012; accepted July 1, 2012.
The work is supported by: The national natural science foundation (61070151), and the national natural science foundation of Fujian (2010J01353), the XMUT research foundation (YKJ11024R), XM scientific research foundation (3502Z20123037). *Corresponding author.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

(Private cloud, Community cloud, Public cloud, Hybrid cloud). Key enabling technologies include: (1) fast wide-area networks, (2) powerful, inexpensive server computers, and (3) high-performance virtualization for commodity hardware.The Cloud Computing model offers the promise of massive cost savings combined with increased IT agility. It is considered critical that government and industry begin adoption of this technology in response to difficult economic constraints. However, cloud computing technology challenges many traditional approaches to datacenter and enterprise application design and management. Cloud computing is currently being used; however, security, interoperability, and portability are cited as major barriers to broader adoption. The long term goal is to provide thought leadership and guidance around the cloud computing paradigm to catalyze its use within industry and government. NIST aims to shorten the adoption cycle, which will enable near-term cost savings and increased ability to quickly create and deploy enterprise applications. NIST aims to foster cloud computing systems and practices that support interoperability, portability, and security requirements that are appropriate and achievable for important usage scenarios[3].

The IOT terminal could be sensors or other non-intelligent devices, these devicess via dedicated connecting devices can be connected to the communication devices, the communication devices could then be connected to the computer network; intelligent IOT terminal can directly communicate with a computer network. The IOT make the connection with computer network.O The development of computer networks form a growing tendency is the cloud computing model, a cloud computing entity connected with IOT terminal has become a part of cloud computing, it can be seen as the cloud entity part, so that the cloud entities service content varies. Intelligent terminal of IOT to interact with the cloud where itself can be seen as a cloud entity, it can be a user at the same time the also provide resources and services for other cloud users.

In addition to the security of the Internet of Things platform security and communications security, in the case of such a high degree of integration with the cloud computing more embodied as cloud entity information exchanging security. Cloud security access control is to protect authorized users can obtain the necessary resources at the same time to prevent unauthorized users from unauthorized access and unauthorized access of authorized users.

The terminals of IOT are closely related to social functioning and people's lives, its terminal nodes are in the social networks everywhere, and the increasing popularity of the Internet of Things can be seen as a process of Internet of things from the level approximation of information technology to the proliferation of social networks. Large-scale social network has a complexity, highly developed Internet of Things will also have this complexity.

In 1999-2003, Bonabeau, chief scientist of Massachusetts Cambridge Consulting Company, found in the research that three kinds of complex networks, including the Internet, human social networks, and cellular metabolic networks are scale-free networks Scale-free complex networks relative to random complex network, the node connection number distribution is exponential or power-type distribution, networks node-hub controls the operation of the scale-free networks, and therefore the network has better robustness, but weaker capability in response to the coordinated attack. Faloutsos from University of California, Faloutso from University of Toronto, Canada, and Faloutsos from Carnegie Mellon University, who are brothers of the same family, conduct accurate modeling of the complex computer networks, but there are so many difficulties in the quantitative modeling of complex spatio-temporal networks and cellular metabolic network. Actually, the modeling research of complex spatio-temporal network has already begun as early as the mid-1970s, the "Social Networks" magazine in the same period has been established, and currently, numerous domestic and international scholars dedicated to research in this field [4] . Complex spatio-temporal networks compared to other complex networks in terms of some of its characteristics, mainly in its motion mechanism stronger dependence on personnel hubs, while staff distributed collection of nodes that have a strong relative stability and level, namely, the personal property of staff hubs will change, but not easy to change the hubs of social attributes, distributed collection of nodes is also very stable, and some collection constitutes a cluster, while the general staff movement between the nodes and hubschanges are accompanied by increase or decrease its impact on the network shown in Figure 1, the hubs for the above changes in the cycle [5]. We call this set of complex spatio-temporal network nodes for the vertical level cycle network node collection. It is precisely because of this, if one of the hubs of complex spatio-temporal network within the changes to keep up with the pace of the operation of the complex spatio-

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

temporal network which will occur within a short time, the contradictions of the interaction between the various hubs in the network. Contradictions one, but the outbreak is showed a divergence of its ability to destroy the entire network even more than coordinated attack [6]; if the distribution node changes fast enough, but not stable enough, will result in the system a short time: the hubs with the surrounding common network node contradictions, after a period of time lead to the vertical level of circulating collection of network nodes contradiction.

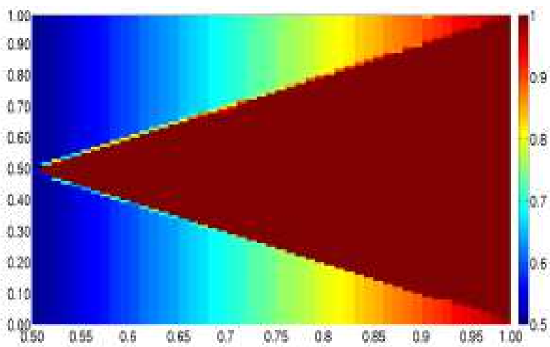

Figure 1 Vertical Level Cycle Network Node Collection

Literature [7] on complex personnel system of risk modeling study, using the state space representation system in variable condition and input/output, use risk function to describe the changes of complex system in macro impact, computer simulation and practical system experiments the model fitting effect is good, can fully describe the complex changes in personnel network and the operation of the social system, so as to the complex system modeling provides a new way to. Literature [8] the risk operation and control flow based on computer network, complex obtained better effect of modeling. Literature [9] of the flexible strategy applied to complex system modeling and quantification, using the method of quantitative control of complex traffic system.

The contribution of this paper is: Aspects of Risk Theory[10] will be extended to the complex spatio-temporal networks, the use of cost function and the risk of node changes function to construct complex spatio-temporal network model; Using flexible quantitative methods to study the state and changes of the complex spatio-temporal networks, building up the establishment of a flexible stack model; constructing a complex spatio-temporal network by a wide range of flexibledual-drive modeling. The model illustrates the role and nature of the distribution node.

2. RISK COST MODEL OF THE COMPLEX SPATIO-TEMPORAL NETWORK

Different from random network, Scale-free network node meet the Matthew effect, As shown in figure 1 shows, In the calculation of the links with k scale-free the world wide web page number, Found links to web pages follow the so-called power distribution laws of time: Any node and other k node is the probability of links, and l/k become direct ratio. For the links into character, n value close to 2, this means that the number of connection only one site into half of the site, In the nets have the site to the quantity of 4 times. Power times and characterization of the laws of random network bell distribution is different. Specific for, not like power times law bell curve, that has a peak, but by the continuous decline to describe the function. If use bi-logarithm coordinates to describe a power law, get is a straight line. As a kind of scale-free networks, complex spatio-temporal network of its internal depends on the different nodes is different, its dependence on coefficient is proportional to the basic nodes and all the other nodes in the network of relevance, node relevance is proportional to the number of connection with links weight.

Sum of the dependence of complex spatio-temporal network of all nodes is proportional to the cost of risk to the network. If the node running the unstable, Hubs run unstable or with the network dynamic behavior does not match, Response to control measures are not taken. The risk cost of the network will grow exponentially (e^x), Growth rate is directly related to the current state of the hubs, For example, a complex intelligence network, the lack of critical nodes will wake up to network outages, The network cost of risk have a direct impact, Risk cost with a sharp change in the topological location and attributes of intelligence nodes. Could then come to the macroscopic complex spatio-temporal networks risk cost function.

$$C = W_\theta \; g(e^{k\theta}) \; g[f(s^\theta)]$$

Which complex spatio-temporal network through the different functions to the power of role of the node status S risks cost function C g is the function of the nodes of the network topology, describing the topological location of the node. So you can get the inference of such a distribution node status change affects the cost of risk:

$$C = W_\theta \; g(e^{k\theta}) \; g[f(s - s')^\theta]$$

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10th March 2013. Vol. 49 No.1

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Data mining can determine the complex spatio-temporal network on different nodes of the dependence coefficient and the exponential growth trend coefficient k [15-17], the problem is transformed into an accurate description of the node changes brought about by the complex spatio-temporal network, set up the modeling procedure and algorithm processes.

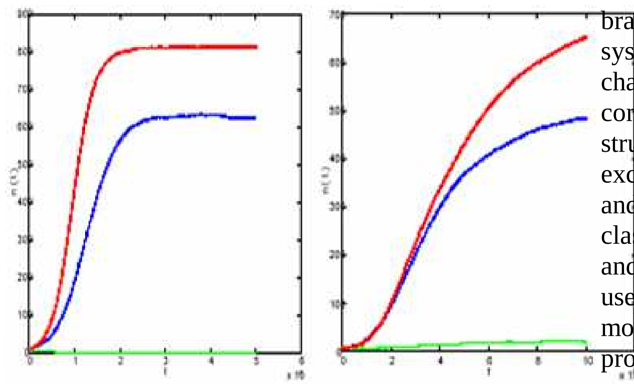

Figure 2 Scale-Free Complex Spatio-Temporal Network Distributed Node Distribution. The Left Shows The Random Distribution Of Network Nodes; The Right One Shows Complex Spatio-Temporal Network Node Distribution.

3. DISCRETE CHARACTERISTICS OF COMPLEX SPATIO-TEMPORAL NETWORK NODE CHANGES AND FLEXIBLE

The changing state of distributed node of complex spatio-temporal network can be considered interactive discrete event. Interactive refers to a node with other nodes in the network information exchange or interaction, energy, and produce a status update. Specific facts is a series of discrete events occur in the time series, they only occurred in discrete, limited time, these events once, will make one or several nodes status variable jump occurs. For the actual complex spatio-temporal networks, the full node state changes as a whole is random: state can be the same node to a number of state transitions, difficult to use mathematical functions to describe the status of all network nodes in real time, only macro-statistical law describes the State of the network.

From the micro topology structure and time differential Angle, state information of network are change with the discrete random events point, and the node state remain unchanged in micro time. Therefore, in the establishment of this type of discrete event model, considering the node status change point, and state the reason of its changes happened, and to describe the network internal state change of dynamic statistical process, the state space are suitable for the former modeling, flexible judgment and quantitative are suitable for the latter modeling.

Flexible research originated in manufacturing, now it has developed into a system an important branch of science, such as flexible strategy, flexible system, etc. Flexible in essence is a dynamic changes of the adaptive capacity, in the construction of flexible classification, including structural flexibility and flexible operation; In excitation response classification including active and passive flexible; In the research object classification including system flexible, flexible and modeling method of flexible, this paper mainly use the modeling idea after both. By flexible modeling method of the uncertainty of the species, property limited small, flexible quantification model is the qualitative to quantitative flexible strategy fusion algorithm steps, set, experts index and model. it human-computer interaction link through recursion and iterative model parameters and feedback from approximation actual system[18,19].

4. FLEXIBLE IPDM DRIVEN MODELING OF COMPLEX SPATIO-TEMPORAL NETWORKS

IPDM is a dynamic state space description of a modeling approach for complex network node. It complex network abstraction as from Bulk stack, stack internal data initialization sequence according to the batch arrangement, can then be freely position changes; of IPDM model is Dynamic open system, the data can at any time from the entry into, from the exit of each incoming and outgoing data to the batch as a unit [7]. IPDM exports has approved, the approval system is responsible for arranging the changes in the system of internal data, at the same time responsible for determining the data to leave the order and time of the stack system; IPDM internal data changes in the state is limited, the same data in a limited state of flux free choice of N times, until you leave the stack system.

This article set the nodes of the complex spatio-temporal network in accordance with the batch changes and status updates, each batch contains at least one node, approved a batch of changes or updates to a period of time only, a batch of internal node movement synchronization.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

A. Node entity description

Set of complex spatio-temporal networks have an entrance (PORTAL,), the new nodes enter the network of topological coordinates (POSITION), the node can be evolutionary, steady state, degradation (PROMOTE, the LEVEL, SUBDUED) and the node disappear or deleted (DIMISSION) operational status.

B. Node flexible description of variables

(1)Describe the PORTAL

EXIST range of {A, B, C, ...}. EXIST = new node entry; EXIST = x node x of a batch in the PORTAL.

(2)Description POSITION

POSITION.TIME.BEGIN (nodes to enter the time), the range of R, refers to a batch node initial access to the topology coordinates, it is a random variable.

POSITION.LEFT.LIST

(Anterior Duration of Change), scope for {A, B, C…}. (x1, t1),(x2, t2)…(xk, tk) refers to a certain batch node from start to get the topological coordinates to end disappear time.

(3) Describe PROMOTE, LEVEL, SUBDUED

PROMOTE.TIME.N; LEVEL.TIME.N; SUBDUED.TIME.N denote respectively treat with different batch node to the N time of evolution, steady-state, degenerate of the start time.

PROMOTE.LEFT.LIST.N, LEVEL.LEFT.LIST.N, SUBDUED.LEFT.LIST.N denote respectively different batch personnel to the N time of evolution, steady-state, degenerate of the duration.

TURN expresses reply order.

POSTIL expresses reply time.

(4) Describe DISMISSION

EXIT.LEAVE scope for {!,A,B,C…}.EXIT.BYE=! means get steady-state, EXIT.LEAVE=x means that the x batch node is degenerating to disappear.

C. Node with the flexible operation double drive modeling

Node minimum state variables sets:

EXIST Typical values: x

POSITION.TIME.BEGIN Typical values: rn

POSITION.LEFT.LIST Typical values: (x1, t1), (x2, t2)…(xk, tk)

PROMOTE.TIME.N Typical values: cpn

LEVEL.TIME.N Typical values: cln

SUBDUED.TIME.N Typical values: csn

PROMOTE.LEFT.LIST.N Typical values: (X1pn, T1pn), (X2pn, T2pn)…(Xkpn, Tkpn)

LEVEL.LEFT.LIST.N Typical values: (X1ln, T1ln), (X2ln, T2ln)…(Xkln, Tkln)

SUBDUED.LEFT.LIST.N Typical values: (X1sn, T1sn), (X2sn,T2sn)…(Xksn, Tksn)

TURN Typical values： U1, U2…Un

TURN.TIME.N Typical values: Tun

POSTIL Typical values: Tn*

EXIT.LEAVE Typical values: X

Interaction with flexible operation process node double drive models to describe:

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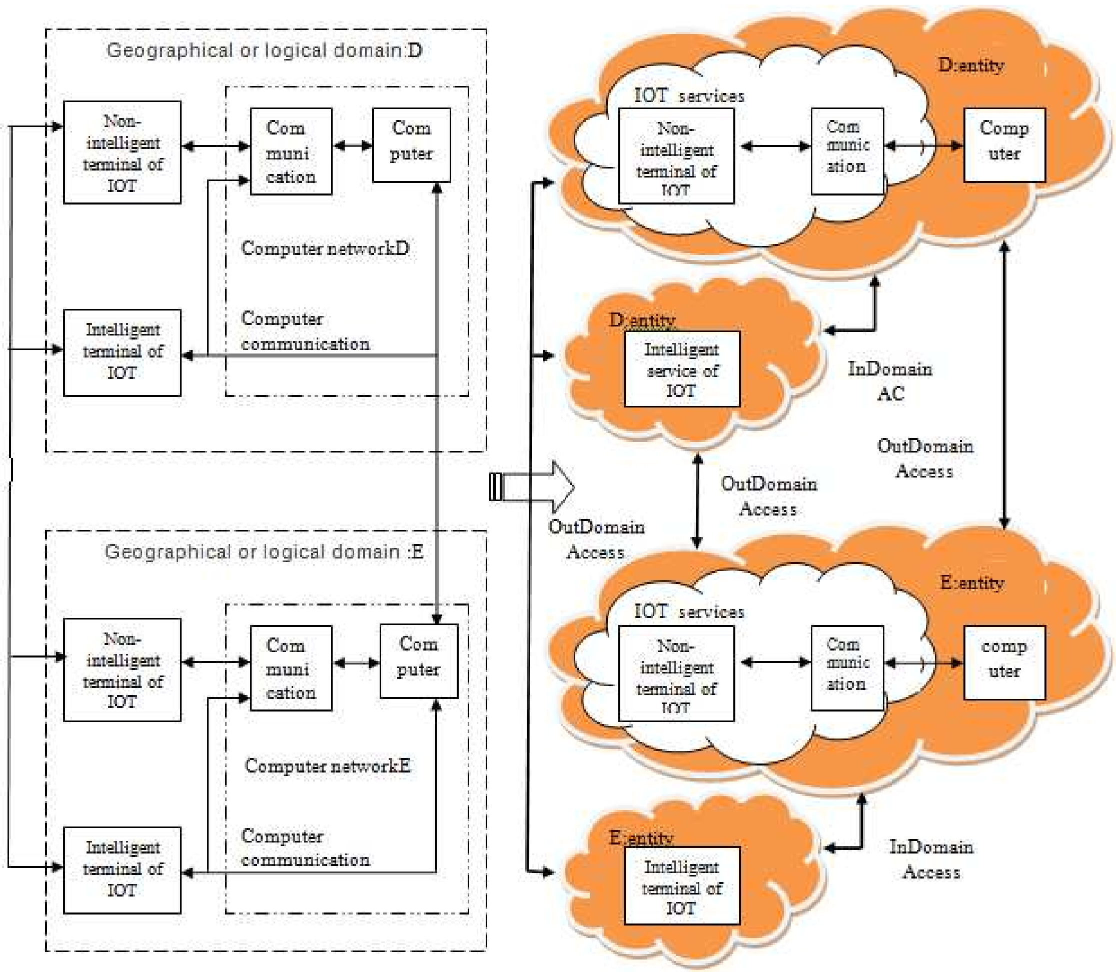

Figure 3 The Mapping Model From The IOT And Cloud Computing To The Internet Of Things Cloud

Problem is transformed into the actual personnel changes in a node state to adapt to the computer to run way to the above model input, which causes the dynamic quantitative results, and to the whole complex network can fast effective information collection, updated.

D. complex spatio-temporal network node state space description

Can use N order state space description: scale-free complex spatio-temporal network all node variables are included in the state space matrix, according to different sampling frequency, state matrix

The State-Space description of any nodes in K from the entrance into the network, through the N times topology coordination change, each coordination change including evolution, steady-state, degradation and leaving the network. If more than a number of nodes changes, changes every time need according to a certain order to accept the higher transform rate of different [22] [23]. The detection frequency and state matrix driving clock frequency is established between the function: according to the complexity of social network macro statistics state and distributed node degree of stability to distinguish the sampling period, changes the driving clock frequency [24]. In order to achieve the state space of the update can be a direct reflection of the complex spatio-temporal network changes and state, node degree of stability and degree of stability of complex spatio-temporal network relations [25].

For a complex spatio-temporal network at any moment state, can be expressed as Norder model. nodes of the audit, the order is the driving clock, in the absence of exceptional circumstances when triggered, to the approval of node is the changing nodes affects the units of reciprocal as the main sequence, on top of this according to the time order, in accordance with these rules can get:

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

$$T_{i+1}=\begin{cases} T_i+T^* & T^*<\min(T_1...T_k) \quad (1)\\ T_i+T^* & T^*=\min(T_1...T_k) \quad (2)\\ T_i+\min(T_1...T_k) & T^*>\min(T_1...T_k) \quad (3)\end{cases}$$

If the higher node reply time due to some unknown factors leading to third situations, then the system within a group of nodes in the queue

K batch node n changes in the state space of continuous change updated dynamically to reflect the complexity of social networks in real time to changes in state and node. Thus the quantitative description of the compute nodes provides a systematic way to changes in the risks of the complex spatio-temporal network operation.

5. COMPLEX SPATIO-TEMPORAL NETWORK MODEL SIMULATION AND TESTING

During the construction of the environment-protection intellectual information in simulation ITO-cloud testing system, early statistics are gained through visual and intellectual system controlled by server computers, the crossing of ITO cloud computing sub-centers, making the i-road instead of the ITO-cloud edge where we have made a successful example in the distributed grid security decision modeling. Here are the nearly results as we set the nearly environment. Two i-roads lead to the exit from east to i-west while one i-road leads to the entrance from i-south to i-north. 2t is spent waiting in line to go across the crossings from east to west on average during rush-hours while t/3 is spent going from i-south to i-north. After analyzing the communication flow condition at this crossing, a feasible scheme should be listed if improvements are required; the statistics of this crossing in detail are as follows. Solution: use of integrated decision-making model improves the cut-off i-left the program as follows:

Option One, in the i-east importation ban i-left measures: the designed capacity for i-east imported straight left lane is $1800\times(1-\frac{1}{2}\times 40\%)=1440\,pcu/h$. The designed capacity for i-east imported straight right lane is 1800T pcu/h; the north import drive is mixed drive straight (the steering is 18 percent, the designed capacity is);

Nowadays in the current signal timing, capacity for the east imports drive is

If a node is changed, the complex spatio-temporal network's status will change to:

waiting for reply above, the complex spatio-temporal network's state to:

$$N_{east}=\sum_{i=1}^{n}\lambda_1\times N_i=\frac{1}{8}\times 1440+\frac{1}{2}\times(1440+1880)$$
$$=1800\,pcu/h$$

Nowadays in the current signal timing, capacity for the north imports drive is

$$N_{noth}=\sum_{i=1}^{n}\lambda_1\times N_i=\frac{1}{4}\times 1638=410\,pcu/h$$

$1800\times(1-\frac{1}{2}\times 18\%)=1638\,pch/h$, i-north actual flow of imports 480puc / h.

Ban i-left rear signal phase adjustment control for the No. 2 that. I-east distributed ratio of imports $\lambda_1{}'\geq\frac{2000}{1800+1800}=\frac{5}{9}$, distributed time of less than 67s, $\lambda_2{}'\geq\frac{480}{1638}=0.293$, distributed time of less than 35s.Take the i-left rear-ban imports of green time of the i-east 70s, i-north imported distributed time 40s. Ban i-left and the peak flow is less than the i-east import capacity, greatly improved communication flow conditions, the average parking east of imported communication flow waiting time is about $\frac{T}{2}$. Through the social behavior and social psychology questionnaires, telephone hotlines, Internet, fax and other channels, on the prohibition of the crowd left the investigation, 25% were against the ban left the grounds for the "no left and bus diversions, is not conducive to travel", the proportion of 20%;"Ban left, I went to the hospital in trouble, "the proportion of 5%, the hospital about 300 meters south exit.

According to the above conditions, integrated decision-making function of the left-ban:

$$O_i=\frac{F(I_i)}{G(C_i)}+H(J_i)+I(E_i)$$

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

U-turn on U-turn area ignored the impact of, $F(I_i)=I_i=I_{ci}=(2T)^2-(\frac{T}{2})^2=3.75T^2$

Ban left negligible cost, $G(C_i)=1+\ln(1+C_i)=1+\ln(1+0)=1$

Through the use of system engineering experience / expert evaluation, "the impact on area residents travel" and a weight of 1, "I go to the hospital in trouble, " a weight of 10, then:

$$N_{noth}=\sum_{i=1}^{n}\lambda_1\times N_i=\frac{1}{4}\times1638=410\,pcu/h$$

$$H(J_i)=l_J*J_i=l_J*\sum k_J*tg(\frac{\pi}{2}\omega)$$
$$=l_J\times(1\times tg\frac{0.2\pi}{2}+10\times tg\frac{0.05\pi t}{2})$$
$$=l_J\times(0.3249+0.7870)=1.1119l_J$$

$$l_J=\frac{T^2}{1+\ln(1+0)}\times\frac{-1}{1\times tg\frac{\pi}{4}}=-T^2$$

$$H(J_i)=-1.119T^2$$

U-turn area 200 meters from the North of imports, the known distance bypass 0.4km, peak hours (17: 00 - 21: 00) bypass flow of about 280pcu / h, then:

$$I(E_i)=l_E*E_i=l_E*k_E\sum(sn)$$
$=l_E\times k_E\times(0.4\times280)=112l_Ek_E$, one factor for the evaluation of environmental impacts, the average fuel consumption of 10L / hundred kilometers, $(E_i)=11.2l_E$, Where l_E for the conversion factor,

$$l_E=\frac{T^2}{1+\ln(1+0)}\times\frac{-1}{k_E\times1\times200}=-\frac{T^2}{200k_E}$$
$$I(E_i)=112l_Ek_E=-0.56T^2$$

So the decision function of left turn restriction is:

$$O_i=\frac{F(I_j)}{G(C_i)}+HJ_i+IE_i$$
$$=\frac{3.75T^2}{1}-1.1119T^2-0.56T^2$$
$=2.0781T^2>0$, from $O_i>0$

We can get the intersection allow left turn restriction. if permissive condition

$$O_i>0=\frac{F(I_j)}{G(C_i)}+HJ_i+IE_i$$
$$=\frac{3.75T^2}{1}-1.1119T^2-0.56T^2$$
$$=2.0781T^2>0$$

Scheme two: Optimize the signal configuration:

Optimize the signal configuration, assuming that still using 3 phase signal control, signal cycle unchanged T=120s,

$$\lambda_1'\geq\frac{2000\times(60\%+20\%)}{1440+1800}=0.4938$$
$$\lambda_2'\geq\frac{2000\times20\%}{1440}=0.2778$$
$$\lambda_3'\geq\frac{200}{1638}=0.122$$

$60+34+15+5\times3=124s>T$, unable to reach optimization purposes.

Optimize the signal configuration, by using two phase signal control, assuming that cycle unchanged, right now, east-west phase signal green letter ratio $\lambda_1'=\frac{2000}{Ne'}$, Ne' is The lanes for discount after communication flow capacity reduction.

$$Ne'=Ne-n_s(N_{le}-N'_{le})$$
$$Ne=1440+1800=2240\,pcu/h$$

ns is for all kinds of straight lane number $ns=2$, N_{le} is for imported car design through word to quantity,

$$N'_{le}=3n=3\times\frac{3600}{T}=3\times\frac{3600}{120}=90\,pcu/h$$

$$Ne'=Ne-n_s(N_{le}-N'_{le})=2400-2\times(400-90)$$
$$=1620\,pcu/h$$

$\lambda_1'+\lambda_2'>1$, two phase signal control can't play optimization function.

(1) Static node classification test Settings:

Test of complex spatio-temporal network IPDM modeling method of node dynamic description ability, inspection based on node state space description of flexible dual driven modeling on node, distributed node, cluster classification ability, node status update tracking ability in the process of classification, quantitative description.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Internal nodes are divided into ordinary cluster node and distributed node two, distributed node number is less than or equal to 5, within the category of cluster nodes represent similar1-294at a common node. As shown in figure 4. The yellow and light blue cluster cluster point of class distinction between general, leading to cross each other, similar aggregation degree to be improved.

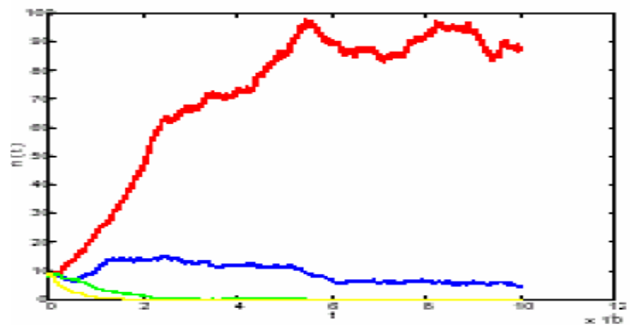

Figure 4 20000node Flexible Dual Drive Model Classification Results. Each Cluster Node Represents A Common Node1-294.

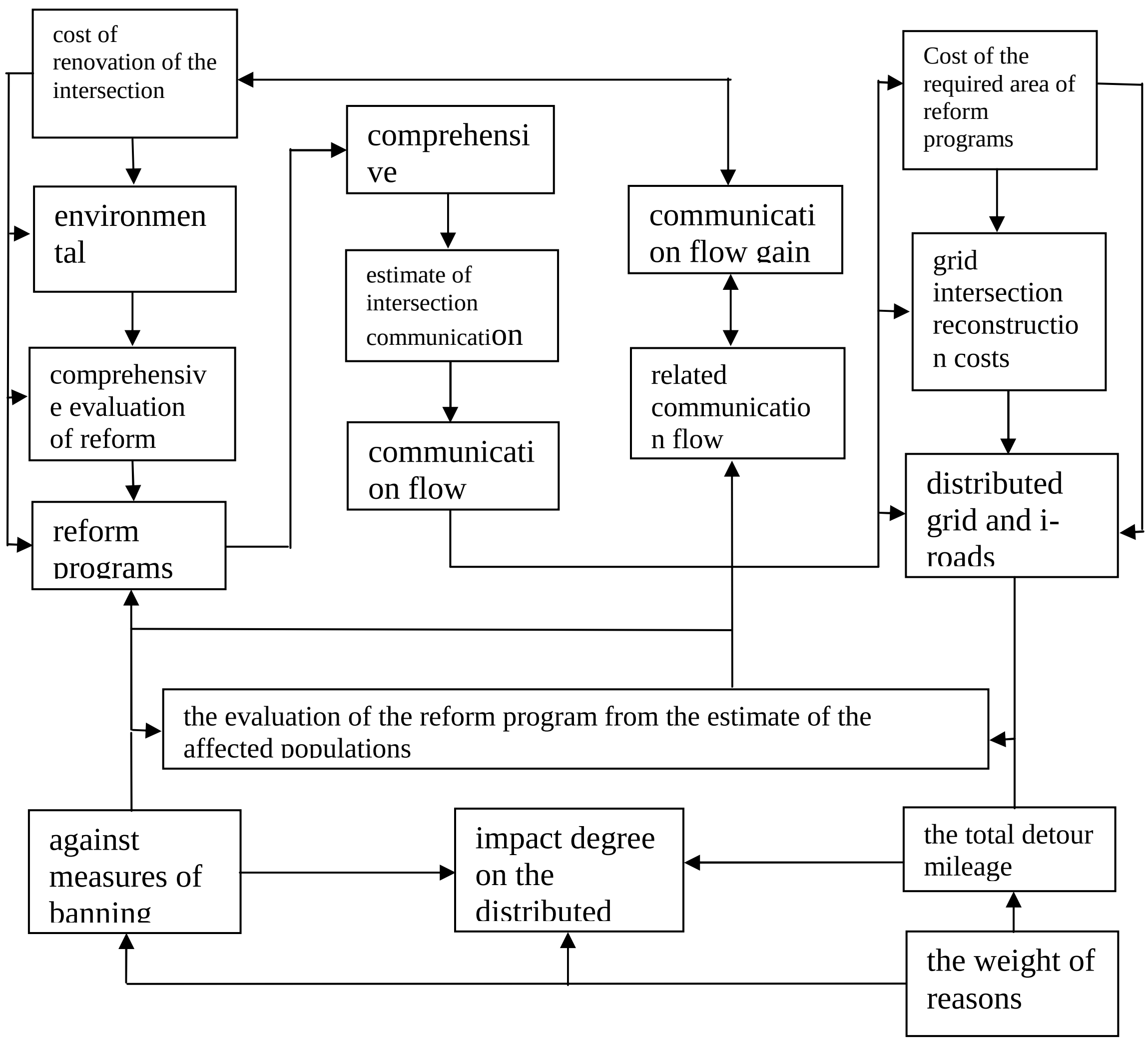

Figure 5 Integrated Prohibited Decision-Making Model

So the flexible dual-drive model of the three complex spatio-temporal networks can be used to describe the state changes of its internal nodes, connecting and the node topology (reference No. [27] translated as changing role), and can classify the complex spatio-temporal network in short

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

period of time. The updating of the node status can bring direct impact on the classification results of the model, and the node connections change has a tremendous impact on the model classification results. It is found that if we use network risk cost to calculate quantitatively the impact, the fluctuate range of network risk value caused by corresponding change of network hub node is much higher than the one caused by the other ordinary node or cluster node within the network, Figure 7 take node status updates and topological coordinate change affection rate to measure the impact of the network node hubs on the network risk cost. The stationary case, distributed node state S f , function and node dependent coefficient W_θ , when the distributing node updates or changes when the network connection, the risk cost of C drastic changes. When distributed node updates and connection rate of change is a linear function, risk cost C will exponentially (e^x) growth, growth rate coefficient K and distributed node internal real time status directly related.

6. CONCLUSION

The results show that, based on flexible IPDM dual-driven modeling and N order state space matrix description method can better reflect the node changes on complex spatio-temporal network effects, the impact and risk cost model to quantify the results. But at the same time can also be found, flexible IPDM double driven modeling in the process of classification efficiency can be further improved, the model can be further optimized; the process of classification between class discrimination to be perfect. Risk cost function parameters and topology description function K coordinates g current through a simple statistical method to derive, function structure of G method and fixed reference questions to be addressed in future work in detail research.

ACKNOWLEDGEMENT

This work was supported by: The national natural science foundation (61070151), , and the national natural science foundation of Fujian (2010J01353), the XMUT research foundation (YKJ11024R).

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