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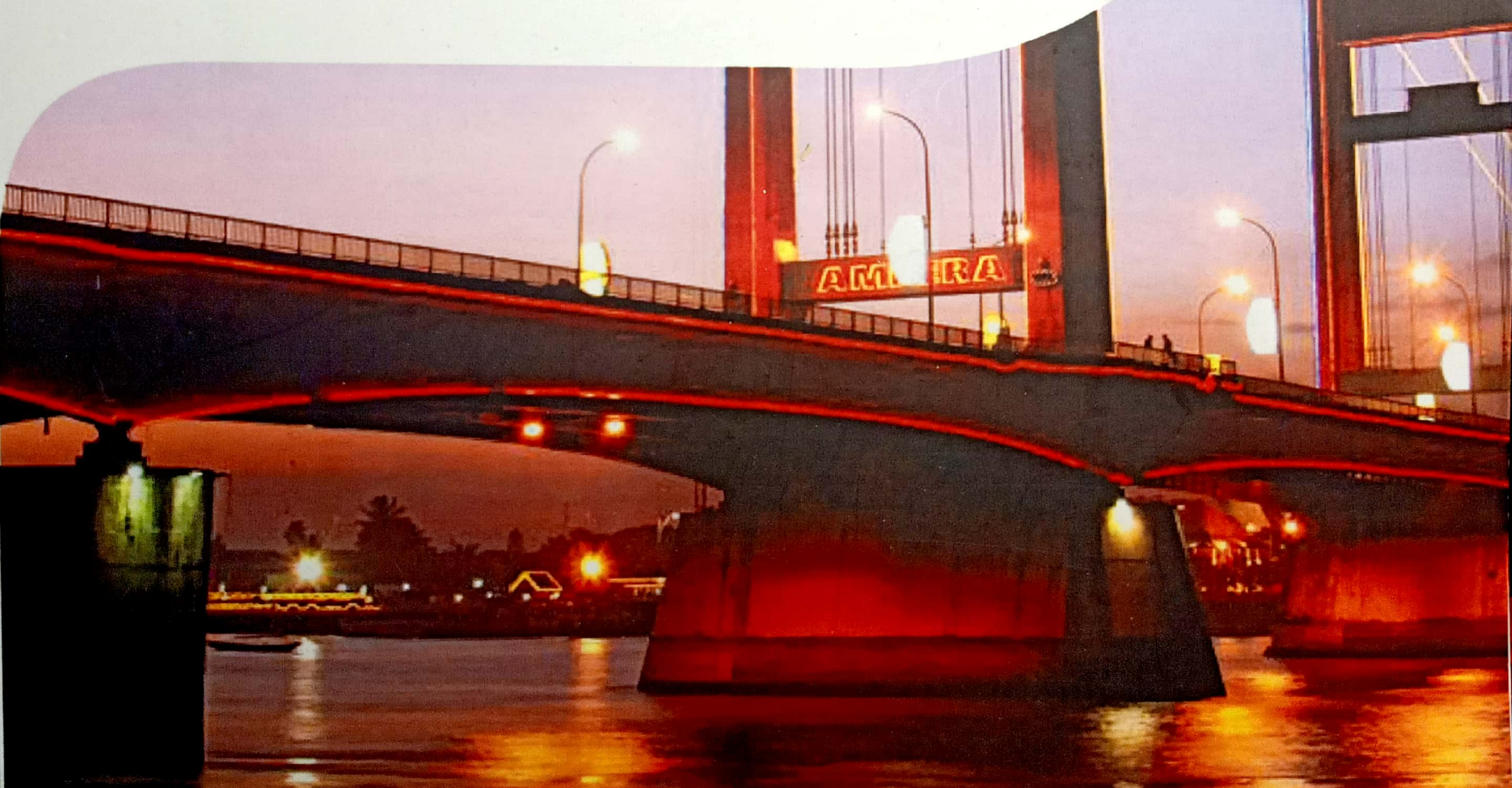
## ELECTRICAL ENGINEERING COMPUTER SCIENCE AND INFORMATICS

# EECSI 2015 CONFERENCE

19-21 Agustus 2015



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## CONFERENCE PROGRAM

### WEDNESDAY, 19 AUGUST 2015

| | | | | |
|---|---|---|---|---|
| 7:30 - 8:00 | Registration | | | |
| 8:00 - 9:15 | Opening ceremony and signing of Memorandum of Understanding (MoU) | | | |
| 9:15 - 9:30 | Coffee break | | | |
| 9:30 - 10:30 | Invited speaker 1:<br>Prof. Dr. Vijay K. Arora ( *Wilkes University, Pennsylvania, USA*)<br>*Quantum Nanoengineering Nonequilibrium High-Electric-Field Transport for Signal Propagation* | | | |
| 10:30 - 12:00 | Parallel session 1 | | | |
| | ROOM 1<br>*Computer Sciences* | ROOM 2<br>*Electronics and Instrumentation* | ROOM 3<br>*Electrical & Power Engineering* | ROOM 4<br>*Information Systems* |
| 12:00 - 13:00 | LUNCH BREAK | | | |
| 13:00 - 13:45 | Invited speaker 2:<br>Dr. Tri Desmana Rachmilda *(Institut Teknologi Bandung, Indonesia)*<br>*Power Electronic Circuit Control Using Hybrid Approach* | | | |
| 13:45 - 15:15 | Parallel session 2 | | | |
| | ROOM 1<br>*Computer Sciences* | ROOM 2<br>*Electronics and Instrumentation* | ROOM 3<br>*Robotics and Control* | ROOM 4<br>*Computer Sciences* |
| 15:15 - 15:30 | coffee break | | | |
| 15:30 - 17:00 | Parallel session 3 | | | |
| | ROOM 1<br>*Computer Sciences* | ROOM 2<br>*Information System* | ROOM 3<br>*Robotics and Control* | ROOM 4<br>*Telecommunication & Wireless* |
| 18:00 - 20:00 | *GALA DINNER* | | | |

### THURSDAY, 20 AUGUST 2015

| | |
|---|---|
| 8:00 - ... | *cultural program (city tours)**<br>*(*with additional arrangement)* |

## ROOM 1

| TIME | NO | CODE | TITLE | PRESENTERS |
|---|---|---|---|---|
| PARALLEL SESSION 1 (10.30 - 12.00) | 1 | CS-01 | Indonesian Hoax News Classification using Feature Selection | Errissya Rasywir and Ayu Purwarianti (Bandung Institute of Technology, Indonesia) |
| | 2 | CS-02 | Design of Knowledge Acquisition Model in Glaucoma Medical Treatments Recommender System | Cut Fiarni (ITHB, Indonesia) |
| | 3 | CS-03 | Novice Assistance Tool and Methodology: Design Decision and Task-Pattern Mapping | Meei Hao Hoo (Universiti Tunku Abdul Rahman, Malaysia); Azizah Jaafar (Universiti Kebangsaan Malaysia, Malaysia) |
| | 4 | CS-04 | Comparison of feature extraction methods for head recognition | Panca Mudjirahardjo (Universitas Brawijaya, Indonesia) |
| | 5 | CS-05 | The Application of fuzzy time series Singh for forecasting bandwidth network demand | Aryanti dan Ikhthison Mekongga (Politeknik Negeri Sriwijaya, Indonesia) |
| | 6 | CS-06 | Numerical Solution for Solving Space-Fractional Diffusion Equations using Half-Sweep Gauss-Seidel Iterative Method | A. Sunarto, J. Sulaiman, A. Saudi (Universiti Malaysia Sabah (UMS) Malaysia, Malaysia) |
| PARALLEL SESSION 2 (13:45 - 15:15) | 7 | CS-07 | Decision Support System For Potential Sales Area of Marketing Product Marketing Using Data Mining | Evasaria Sipayung (Institut Harapan Bangsa, Indonesia) |
| | 8 | CS-08 | Generalized MINLP of Internet Pricing Scheme under Multi Link QoS Networks | Fitri Maya Puspita and Irmeilyana Saidi Ahmad (Universitas Sriwijaya, Indonesia) |
| | 9 | CS-09 | NET.OS:Network Server Operating Systems Based on Open Source | Evan Enza Rizqi, Idhawati Hestingsih, Mardiyono (Politeknik Negeri Semarang, Indonesia) |
| | 10 | CS-10 | The Optimized K-Means Clustering Algorithms To Analyzed the Budget Revenue Expenditure in Padang | Dony Novaliendry (State University of Padang & National Kaohsiung University of Applied Sciences, Taiwan); Cheng-Hong Yang (National Kaohsiung University of Applied Sciences, Taiwan); Yeka Hendriyani and Hafilah Hamimi (State University of Padang, Indonesia) |
| | 11 | CS-11 | Performance Analysis on Text Steganalysis Method Usin A Computational Intelligence Approach | Roshidi Din, Shafiz Affendi Mohd. Yusof (UUM, Malaysia); Azman Samsudin (USM, Malaysia); Angela Amphawan UUM Kedah & MIT Malaysia); Hanizan Shaker Hussain, Md Hanafizah Ya'acob Hanafiza Yaacob and Siti Nazuha Jamaludin (Kolej Poly-Tech MARA (KPTM), Malaysia) |
| | 12 | CS-12 | Pattern Recognition on Paper Currency's Feature using LVQ Algorithm | Dewanto Harjunowibowo (Sebelas Maret University, Indonesia) |
| PARALLEL SESSION 3 (15.30 - 17.15) | 13 | CS-13 | Enhanced Ridge Direction for the Estimation of Fingerprint Orientation Fields | Saparudin (Universitas Sriwijaya, South Sumatera, Indonesia) |
| | 14 | CS-14 | Virtualization Technology for Optimizing Server Resource Usage | Edwar Ali (STMIK-AMIK RIAU, Indonesia) |
| | 15 | CS-15 | Nonlinear Programming Approach of Wireless Pricing Models | Irmeilyana Saidi Ahmad (Universitas Sriwijaya, Indonesia) |
| | 16 | CS-16 | Segmentation of Urdu Nastaliq Script using Structural Features | Aliya Khan (National University of Science and Technology, Pakistan) |
| | 17 | CS-17 | New Framework for Constructing a Virtual Routing Table in the IGP Networks | Radwan Abujassar (Bursa Orhangazi University, Turkey) |
| | 18 | CS-18 | Implementation of Audio Watermarking using Fast Fourie Transform for AudioDigital Copyright Protection | Megah Mulya, Yogha Saputra Utama (Universitas Sriwijaya, Indonesia) |
| | 19 | CS-19 | Application of NFC Technology for Cashless Payment System in Canteen | Evizal Abdul Kadir (Faculty of Computing , Universiti Teknologi Malaysia, Malaysia); Sri Listia Rosa (Universitas Islam Riau, Indonesia) |
| | 20 | CS-20 | The Big Data Management Prototype Development for Analysis Various of Data | S Heri Pracoyo (Bina Nusantara University, Indonesia) |

## TABLE OF CONTENTS

# Generalized MINLP of Internet Pricing Scheme under Multi Link QoS Networks

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Faculty of Mathematics and Natural Sciences, Sriwijaya University, Inderalaya, Ogan Ilir
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***Abstract*-In this paper, we will generalize the multi link internet charging scheme in multi class QoS network. This scheme is designed according to the base price, quality premium and quality of service to help the service provider to set up the parameters to optimize the service provider's profit and to serve better quality of service. The objective function is formed by setting up the base price as a constant and setting up quality premium as a parameter and a variable. Models are in form of Mixed Integer Nonlinear Programming Problem and are solved by using LINGO 13.0 to obtain the optimal solutions. The results show that in case when we set up the base price as a parameter with varying the quality premium, fixing the sensitivity price of user I in class j and also varying the sensitivity of class j, the highest optimal solution was achieved. The modified model also gives better optimal solution compared to original model. It means that by fixing base price, ISP is able to goal its objective by recovering cost and promoting certain services.**

## I. INTRODUCTION

The challenge to provide better quality of internet is essential for ISP. The network service quality is determined by the users' satisfactoriness. ISPs have a task to offer better and different QoS to the users to reach the best information quality and also to gain the profit from the available resources. The knowledge to develop the new pricing scheme under user willingness and the providers are provided but only few involve QoS network [1-4].

Yang [5] and Yang et al.[5-8] have conducted the research focused on internet pricing on multi class QoS by describing the auction scheme in obtaining the optimal solution. In fact, there exist some parameters affected QoS which can be considered.

This paper basically attempts to offer the generalized optimal solution of by applying the improved models for internet pricing in multi link with more classes based on [9] models. The results obtained can assist ISP to choose the best pricing scheme satisfying the users. So, the contribution is created by improving the mathematical formulation of [5, 9, 10] into new formulation by taking into consideration the utility function, base price as fixed price or variable, quality premium as fixed prices and variable, index performance, capacity in more than one link and also bandwidth required. The problem of internet charging scheme is considered as Mixed Integer Nonlinear Programming (MINLP) to obtain optimal solution by using LINGO 13.0 [11] software. In this part, we generalize the model proposed previously by [1, 2] with the extension for multi link network then the comparison of the models is conducted in which whether decision variable is to be fixed of user admission to the class or not. This study focuses to vary the quality premium parameters and see what decision can be made by ISP by choosing this parameter.

## II. LITERATURE REVIEW

Table I and Table II below present the several past research focusing on internet pricing and current research on wired internet pricing under multiple QoS network.

TABLE I
SEVERAL PAST RESEARCH ON INTERNET PRICING

| Pricing Strategy | How it Works |
|---|---|
| Responsive Pricing [12] | Three stages proposed consist of not using feedback and user adaptation, using the closed-loop feedback and one variation of closed loop form. |
| Pricing plan [13] | It Combines the flat rate and usage based pricing. Proposed pricing scheme offers the user a choice of flat rate basic service, which provides access to internet at higher QoS, and ISPs can reduce their peak load. |
| Pricing strategy [10] | Based on economic criteria. They Design proper pricing schemes with quality index yields simple but dynamic formulas'. Possible changes in service pricing and revenue changes can be made |
| Optimal pricing strategy [14] | The schemes are Flat fee, Pure usage based, Two part tariff. Supplier obtains better profit if chooses one pricing scheme and how much it can charge. Two part of analysis homogenous and heterogeneous. |
| Paris Metro Pricing [15, 16] | Different service class will have a different price. The scheme makes use of user partition into classes and move to other class it found same service from other class with lower unit price. |
| Internet pricing proposed by [17] | Internet pricing according to cost analysis. The categories are flat pricing, where ISPs use one price to charge users based on a specified time and users have equal speed access and equal price. The second category is based on usage pricing, where the pricing scheme charges the amount of traffic uploaded and downloaded. |
| Pricing schemes proposed by [18] | Pricing schemes based on QoS levels in different allocations that control congestion and load balance. Multiple class QoS networks require differentiated pricing schemes for allocations of different levels of service traffic. |

This model is was improved from by taking the case of a base price ($\alpha$) as a constant and quality premium ($\beta$) as constants and variable. The modified model can be divided into two type , namely $W_{ij}$ as a parameter and $W_j$ as parameter, and $W_{ij}$ as parameter $W_j$ as variable. The generalized model is solved by LINGO 13.0 super version for educational purpose is only for 2 users, 2 classes and 2 links.

## III. RESULTS AND DISCUSSIONS

### A. Original Model

Original model was adopted from .

$$\max R = \sum_{j=1}^{m}\sum_{i=1}^{n} \alpha_j \cdot Z_{ij} + W_j \cdot \log \frac{\hat{X}_{ij}}{L_j} \quad (1)$$

dengan kendala

$$\sum_{j=1}^{m}\sum_{i=1}^{n} \hat{X}_{ij}^{k} \le C_k, \quad k = 1, \dots, r \quad (2)$$

$$\tilde{X}_{ij}^{k} = \hat{X}_{ij} \quad (3)$$

$$\hat{X}_{ij} = \tilde{L}_{ij}^{k} \quad (4)$$

$$\hat{X}_{ij} \ge Z_{ij} \quad (5)$$

$$W_j \le \tilde{W}_{ij}^{k} + (1 - Z_{ij}) \quad (6)$$

$$L_j \le \tilde{L}_{ij}^{k} + (1 - Z_{ij}) \quad (7)$$

$$\hat{X}_{ij} \ge X_j - (1 - Z_{ij}) \quad (8)$$

$$\hat{X}_{ij} \ge X_j \quad (9)$$

$$\hat{X}_{ij} \ge 0 \quad (10)$$

$$L_j \ge 0 \quad (11)$$

$$W_j \ge 0 \quad (12)$$

$$Z_{ij} = \begin{cases} 1, if\ user\ i\ in\ allowed\ in\ j \\ 0, \quad otherwise \end{cases} \quad (13)$$

with $i = 1,\dots, n$ ; $j = 1,\dots, m$ ; $k= 1,\dots, r$.

$c_j$ is determined as the upper bound value of sensitivity price for each user $i$ in class $j$ of link $k$.

### B. Model by fixing $\alpha_j$ and $\beta_j$

The model was adapted from .

$\tilde{W}_{ij}$ as parameter and $W_j$ as variable

$$maks\ R = \sum_{j=1}^{m}\sum_{i=1}^{n}((\alpha_j \cdot Z_{ij} + \beta_j \cdot I_j) + w_j log \frac{\tilde{X}_{ij}}{L_{m_j}}) \quad (14)$$

Subject to Eq (2) -Eq (12) and

$$\alpha_j + \beta_j \cdot I_j \ge \alpha_{j-1} + \beta_{j-1} \cdot I_{j-1} \quad (15)$$

$$0 < I_j < d_j. \quad (16)$$

$$\tilde{W}_{ij} = c_j \quad (17)$$

$\tilde{W}_{ij}$ parameter dan $W_j$ parameter

Add new constraint as follows.

$$W_j = d_j \quad (18)$$

With $d_j$ as the upper bound of quality index in class j.

### C. Model by fixing $\alpha_j$ and varying $\beta_j$

The model was adapted from .

$\tilde{W}_{ij}$ parameter dan $W_j$ variable

Max the objective function (14) subject to Eq (2-Eq (13) and Eq (15) to Eq (18). Adding the new constraints, we have

$$\beta_j \le \beta_{j-1} \quad (19)$$

$$f \le \beta_j \le g \quad (20)$$

$\tilde{W}_{ij}$ parameter dan $W_j$ parameter

Max the objective function (14) subject to Eq (2) to Eq (13), Eq (15) to Eq (20).

with

- $\alpha_j$ : Base price for class $j$.
- $Z_{ij}$ : $\begin{cases} 1, \text{if user i in allowed in j} \\ 0, \quad \text{otherwise} \end{cases}$
- $W_j$ : Sensitivity price for class $j$.
- $\tilde{X}_{ij}^{k}$ : Final bandwidth obtained by user $i$ in class $j$ of link $k$.
- $\tilde{L}_{ij}^{k}$ : Minimum bandwidth for user $i$ in class $j$ of link $k$.
- $L_j$ : Minimum Bandwidth for class $j$.
- $Q$ : Total bandwidth.
- $\tilde{W}_{ij}$ : Sensitivity price for user $i$ in class $j$.
- $V_i$ : Minimum bandwidth needed for user $i$.
- $X_j$ : Bandwidth for each user in class $j$.
- $\beta_j$ : Premium quality of class $j$ having service performance $I_j$
- $I_j$ : Quality index of class $j$.
- $r$ : Number of link
- $f$ : Floor value for quality premium in class $j$
- $g$ : Ceiling value for quality premium in class $j$

The solution of the mixed integer nonlinear programming problem is solved using LINGO 13.0 to obtain the optimal solution. Table III and Table IV present the results.

TABLE III
SOLVER STATUS OF ORIGINAL MODEL, MODEL BY FIXING BASE PRICE AND QUALITY PREMIUM AND ALSO MODEL BY FIXING BASE PRICE AND VARYING THE QUALITY PREMIUM

| | Original |
|---|---|
| Model Class | MINLP |
| State | Local Optimal |
| Objective | 176.768 |
| Infeasibility | 0 |
| Iterations | 14 |
| Solver Type | Branch and Bound |
| Steps | 0 |
| Active | 0 |
| GMU | 32K |
| ER | 1s |

In Table III and Table IV, the solver status of each case was shown. All models are solved by using LINGO 13.0. the model is mixed integer nonlinear programming with status of local optimal. The solver type is branch and bound with the number of memory used between 32K-35K.

TABLE IV
SOLVER STATUS OF MODEL BY FIXING BASE PRICE AND QUALITY PREMIUM AND ALSO MODEL BY FIXING BASE PRICE AND VARYING THE QUALITY PREMIUM

| | $\beta_j$ Fixed $\tilde{W}_{ij}$ Par | $\beta_j$ Fixed $\tilde{W}_{ij}$ Par | $\beta_j$ Var $\tilde{W}_{ij}$ Par | $\beta_j$ Var $\tilde{W}_{ij}$ Par |
|---|---|---|---|---|

| | $W_j$ Par | $W_j$ Var | $W_j$ Par | $W_j$ Var |
|---|---|---|---|---|
| Model Class | MINLP | MINLP | MINLP | MINLP |
| State | Local Optimal | Local Optimal | Local Optimal | Local Optimal |
| Objective | 110.645 | 176.874 | 110.709 | 176.938 |
| Infeasibility | 0 | $1.1\text{x}10^{-13}$ | 0 | $1.1\text{x}10^{-13}$ |
| Iterations | 24 | 33 | 25 | 34 |
| Solver Type | Branch and Bound | Branch and Bound | Branch and Bound | Branch and Bound |
| Steps | 0 | 0 | 0 | 0 |
| Active | 0 | 0 | 0 | 0 |
| GMU | 35K | 34K | 36K | 35K |
| ER | 1s | 0s | 0s | 1s |

TABLE V
DECISION VARIABLE VALUES FOR ORIGINAL MODEL

| | Original |
|---|---|
| $X_1$ | 0 |
| $X_2$ | 0 |
| $W_1$ | 8 |
| $W_2$ | 10 |
| $\beta_1$ | - |
| $\beta_2$ | - |
| $L_1$ | 7 |
| $L_2$ | 7 |
| $\hat{X}_{11}$ | 931.399 |
| $\hat{X}_{12}$ | 931.399 |
| $\hat{X}_{21}$ | 931.399 |
| $\hat{X}_{22}$ | 931.399 |
| $Z_{11}$ | 1 |
| $Z_{12}$ | 0 |
| $Z_{21}$ | 0 |
| $Z_{22}$ | 1 |
| $\tilde{X}^1_{11}$ | 931.399 |
| $\tilde{X}^2_{11}$ | 931.399 |
| $\tilde{X}^1_{12}$ | 931.399 |
| $\tilde{X}^2_{12}$ | 931.399 |
| $\tilde{X}^1_{21}$ | 931.399 |
| $\tilde{X}^1_{21}$ | 931.399 |
| $\tilde{X}^1_{22}$ | 931.399 |
| $\tilde{X}^2_{22}$ | 931.399 |
| $I_1$ | - |
| $I_2$ | - |

Table V and Table VI show that all models, the bandwidth obtained ($\hat{X}_{ij}$) is 931.399 kbps which is the capacity for link 2. The minimum bandwidth for $L_1$and $L_2$ for original case and for the case when varying the sensitivity price for class $j$. Price sensitivity for class 1 and 2 ($W_1$ and $W_2$) are 8 and 10 when we vary the price sensitivity. ISP obtain the highest optimal solution by setting up the base price to be fixed, quality premium to be varied, sensitivity price for user $I$ in class $j$ to be fixed and sensitivity price for class $j$ . The results show that the modified model in two cases share slightly better result that the original model. The advantage of the modified model that ISP is able to know its quality premium and quality index which are unavailable in original model.

TABLE VI
DECISION VARIABLE VALUES FOR MODEL BY FIXING BASE PRICE AND QUALITY PREMIUM AND ALSO MODEL BY FIXING BASE PRICE AND VARYING THE QUALITY PREMIUM

| | $\beta_j$ Fixed $\tilde{W}_{ij}$ Par $W_j$ Par | $\beta_j$ Fixed $\tilde{W}_{ij}$ Par $W_j$ Var | $\beta_j$ Var $\tilde{W}_{ij}$ Par $W_j$ Par | $\beta_j$ Var $\tilde{W}_{ij}$ Par $W_j$ Var |
|---|---|---|---|---|
| $X_1$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $X_2$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $W_1$ | - | 8 | | 8 |
| $W_2$ | - | 10 | | 10 |
| $\beta_1$ | - | - | 0.05 | 0.05 |
| $\beta_2$ | - | - | 0.05 | 0.05 |
| $L_1$ | 6 | 7 | 6 | 7 |
| $L_2$ | 7 | 7 | 7 | 7 |
| $\hat{X}_{11}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\hat{X}_{12}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\hat{X}_{21}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\hat{X}_{22}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $Z_{11}$ | 1 | 1 | 1 | 1 |
| $Z_{12}$ | 1 | 0 | 1 | 0 |
| $Z_{21}$ | 1 | 0 | 1 | 0 |
| $Z_{22}$ | 1 | 1 | 1 | 1 |
| $\tilde{X}^1_{11}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\tilde{X}^2_{11}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\tilde{X}^1_{12}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\tilde{X}^2_{12}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\tilde{X}^1_{21}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\tilde{X}^1_{21}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\tilde{X}^1_{22}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $\tilde{X}^2_{22}$ | 931.399 | 931.399 | 931.399 | 931.399 |
| $I_1$ | 0.8 | 0.8 | 0.8 | 0.8 |
| $I_2$ | 0.9 | 0.9 | 0.9 | 0.9 |

## IV. CONCLUSION

The Generalized improved models for internet pricing model in 2 link class QoS network with 2 users and 2 classes with the base price as a constant and quality premium as a constant or a variable by setting up the user i sensitivity in class $j$ ($\tilde{W}_{ij}$) and sensitivity in class $j$ ($W_j$) can be solved to obtain the better maximum profit for according to ISP' preferences. The solutions show the connections between $\tilde{W}_{ij}$ and $W_j$ as a parameter or variable in maximizing the revenue. In the modified model, the highest maximum revenue in case where $\tilde{W}_{ij}$ as parameter and $\mathrm{W_j}$ as variable is achieved.

## ACKNOWLEDGMENT

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## REFERENCES

[1] Irmeilyana, Indrawati, F. M. Puspita and L. Herdayana, , *Improving the Models of Internet Charging in Single Link Multiple Class QoS Networks*, in *Advanced Computer and Communication Engineering Technology*, H.A. Sulaiman, et al., Editors. 2015, Springer Publishing International: Switzerland.

[2] Irmeilyana, Indrawati, F. M. Puspita, R. Sitepu and R. T. Amelia, , General*ized models for internet pricing scheme under multi class QoS networks.* Australian Journal of Basic and Applied Sciences, 2014. August: p. 543-550.

[3] F.M. Puspita, K. Seman, B. M. Taib and Z. Shafii, *Improved Models of Internet Charging Scheme of Single Bottleneck Link in Multi QoS Networks.* Journal of Applied Sciences, 2013. 13(4): p. 572-579.

[4] F.M. Puspita, K. Seman, B. M. Taib and Z. Shafii, *Improved Models of Internet Charging Scheme of Multi bottleneck Links in Multi QoS Networks.* Australian Journal of Basic and Applied Sciences, 2013. **7**(7): p. 928-937.

[5] Yang, W., *Pricing Network Resources in Differentiated Service Networks*, in *School of electrical and Computer Engineering*. 2004, Phd Thesis. Georgia Institute of Technology. p. 1-111.

[6] Yang, W., et al. *An Auction Pricing Strategy for Differentiated Service Network*. in *Proceedings of the IEEE Global Telecommunications Conference*. 2003: IEEE.

[7] Yang, W., H. Owen, and D.M. Blough. *A Comparison of Auction and Flat Pricing for Differentiated Service Networks*. in *Proceedings of the IEEE International Conference on Communications*. 2004.

[8] Yang, W., H.L. Owen, and D.M. Blough. *Determining Differentiated Services Network Pricing Through Auctions*. in *Networking-ICN 2005, 4th International Conference on Networking April 2005 Proceedings, Part I*. 2005. Reunion Island, France, : Springer-Verlag Berlin Heidelberg.

[9] F.M. Puspita, Irmeilyana, Indrawati, Juniwati and L. Dumepa, , *Multi Link Internet Charging Scheme Serving Multi Class QoS*, in *International Conference on Education, Technology and Sciences, Jambi*. 2014: Jambi.

[10] J. Byun, and S. Chatterjee. *A strategic pricing for quality of service (QoS) network business*. in *Proceedings of the Tenth Americas Conference on Information Systems*. 2004. New York.

[11] LINGO, *LINGO 13.0.2.14*. 2011, LINDO Systems, Inc: Chicago.

[12] J.K MacKie-Mason, L. Murphy, and J. Murphy, *The Role of Responsive Pricing in the Internet*, in *Internet Economics* J. Bailey and L. McKnight, Editors. 1996, Cambridge: MIT Press. p. 279-304.

[13] J. Altmann, and K. Chu, *How to charge for network service-Flat-rate or usage-based?* Special Issue on Networks and Economics, Computer Networks, 2001. **36**: p. 519-531.

[14] S.-y.Wu, , P.-y. Chen, and G. Anandalingam, *Optimal Pricing Scheme for Information Services*. 2002, University of Pennsylvania Philadelphia.

[15] D.Ros, and B. Tuffin, *A mathematical model of the paris metro pricing scheme for charging packet networks.* The International Journal of Computer and Telecommunications Networking - Special issue: Internet economics: Pricing and policies 2004. **46**(1).

[16] Tuffin, B., *Charging the internet without bandwidth reservation: An overview and bibliography of mathematical approaches.* Journal of Information Science and Engineering, 2003. **19**(5): p. 765-786.

[17] H.He, K. Xu, and Y. Liu, *Internet resource pricing models, mechanisms, and methods.* Networking Science, 2012. **1**(1-4): p. 44-68.

[18] C. Gu, S. Zhuang, and Y. Sun, *Pricing incentive mechanism based on multistages traffic classification methodology for QoS-enabled networks.* Journal of Networks, 2011. **6**(1): p. 163-171.