Model and Optimal Solution of Single Link Pricing Scheme *Multiservice Network*

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Abstrak

Pada paper ini akan dibentuk skema pembiayaan internet baru pada jaringan multi layanan dengan beberapa modifikasi dari model [1]. Skema baru ini dibentuk dengan mengatur harga dasar, kualitas premium dan kualitas layanan (QoS). Skema tersebut dibuat bertujuan untuk membantu penyedia layanan internet (ISP) dalam memaksimumkan pendapatan dan memberikan kualitas layanan yang lebih baik bagi pengguna. Fungsi tujuan yang dibentuk dengan mengatur harga dasar dan premium kualitas sebagai variable maupun konstanta. Model yang akan digunakan berupa persamaan nonlinier dan diselesaikan dengan program LINGO 11.0 untuk mendapatkan hasil solusi optimal. Pembahasan menunjukkan bahwa untuk setiap kasus dengan model perbaikan, ISP mendapatkan solusi optimal yang lebih baik dengan menetapkan harga dasar dan premium kualitas sebagai variabel atau konstanta.

Kata kunci: *pembiayaan internet, kualitas layanan, penyedia layanan internet, harga dasar, premium kualitas*

Abstract

This paper discussed the new improved and modified internet pricing scheme in multiservice networks [1]. This new improved scheme is created to set up the base price, quality premium and Quality of service (QoS). This scheme has the purposes to help Internet Service Provider (ISP) in maximizing the revenue and contribute better quality of service to the users. The objective function will be formed to set up the base price and quality premium as a vaiable or a constant. The models used are in nonlinear forms and solved by using LINGO 11.0 to get the optimal solution. The results show that for each cases of improved scheme, ISP gets better optimal solutions by varying or fixing the base price and quality premium.

Keywords: *internet pricing, quality of service, internet service provider, base price, quality premium*

1. Introduction

Internet has an important role in development of global economy. Internet Service Provider provides best service to fulfill user needs. ISP competes in increasing their service quality and maximizes the revenue with that quality. The way to provide maximum revenue is by providing Quality of Service (QoS) [2-4] for users. By giving the different level of services, ISP is able to improve the new resources for itself and the company using this new framework can improve new digital product [5] .

Pricing scheme problem actually is not a new case for ISP. ISP has to find a new way to echieve their goals. Determining the product or service price is a critical task that should be fulfilled by an organization. With the right price, the company can gain the consumers, maintain and obtain the profit [5]. ISP deals with the preference of users to use flat fee pricing scheme due to its simplicity and profitability. The customers are able to access all internet connection with only pay monthly subscription fee. However, this scheme is not profitable to ISP. ISP should be able to come up with the nes pricing scheme that is profitable for them.

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[1, 6, 7] investigated the pricing scheme in multiservice network by considering the prices, capacity allocation and QoS in maximizing ISP profit. This basic optimization model is proposed to determine the optimal solution of capacity allocation, QoS level for each class and maximum user for each service.

ISP offers some chosen service qualities that are suitable for users' need and budget. The customers will get the best by paying the highest price or otherwise. [8-18] have investigated the improved internet pricing scheme in multi QoS networks. ISP gets some choises to adapt the new improved model according to ISPs' goals.

The contribution of this paper basically to give improvement of the improved pricing scheme proposed previously by [1, 6, 7] by considering cases to vary the quality index, base price and quality premium. Based on that improved model, the ISP can determine which schemes offer best pricing strategy that can be adopted.

2. Research Method

In this paper, we will solve the optimization problem by using LINGO 11.0. We are given the parameters and asked to find the variable solutions in maximizing ISP profit. After modeling the formulation, we solve the model by using the tool to get the optimal solution. The solutions are enabling us to interpret and explain the trends in pricing scheme, network, capacity and QoS level.

3. Results and Analysis

In solving the problem of pricing scheme model, we adopt the same models, parameters and variables stated in [1] but we have different ways in maximizing the revenue. We will improve the models by modifying some parameters and variables such as index quality, base price and quality premium for each service. We have to consider every cases for determining the parameter and variables.

So here, we will consider 2 cases that are case 1 by setting up α and β as variables and case 2 by setting up α as variable and β as a constant. We use LINGO 11.0 to solve the optimization model to obtain the optimal solutions. Table 1-20 below show the optimal solutions by LINGO 11.0. This problem is calle mixed integer nonlinear programming (MINLP) since there exist at least one nonlinear equation.

Tabel 1. Solver Status of Case 1 by Modifying Index Quality

Solver Status	$I_j = I_{j-1}$	$I_j > I_{j-1}$	$I_j < I_{j-1}$
Model Class	MINLP	MINLP	MINLP
State	Local Optimal	Local Optimal	Local Optimal
Objective	567	567	491.4
Infeasibility	0	5.55×10^{-17}	1.11×10^{-16}
Iterations	13	12	13
Extended Solver Status			
Solver Type	Branch and Bound	Branch and Bound	Branch and Bound
Best Objective	567	567	491.4
Objective Bound	567	567	491.4
Steps	0	0	0
Update Interval	2	2	2
Generated Memory Used(K)	28	28	28
Elapsed Time(S)	0	1	0

In Table 1 above, we compare three modified optimal solutions for case 1. We obtain highest maximum by setting up $I_j = I_{j-1}$ dan $I_j > I_{j-1}$. From the above solution by modifying index quality, we obtain maximum profit of 67. However in $I_j = I_{j-1}$ case, it takes smallest Elapsed time to finish the iterations. Then $I_j = I_{j-1}$ case yields the best solution in maximizing ISP profit

Tabel 2. Optimal Solution of Case 1 for $l_j = l_{j-1}$

Solution for $l_j = l_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Harga dasar (α_i)	0.2	0.5	0.6
Kualitas Premium (β_i)	0.8	0.4	0.3
Share of total network capacity(a_i)	0.2	0.5	0.3
Level QoS (l_i)	0.9	0.9	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($l_i*d_i*x_i$)	540	6750	3300
Total capacity used($\sum l_i*d_i*x_i$)		10590	
Profit per service (($\alpha_i+\beta_i*l_i$)*p_i*x_i)	27	405	135
Total profit ($\sum$ ($\alpha_i+\beta_i*l_i$)*p_i*x_i		567	

Next, in Table 2, we get the optimal solutions for $l_j = l_{j-1}$ case of 567. We can see from that table that the used capacity per service is achieved in service i =2 of 6750 kbps with users applying the service is 10 users. Total bandwidth used for all service is 10,590 kbps or 75.8 % of total bandwidth given.

Tabel 3. Optimal Solution of Case 1 for $l_j > l_{j-1}$

Solution for $l_j > l_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.4	0.5	0.6
Premium quality (β_i)	0.8	0.5	0.3
Share of total network capacity(a_i)	0.3	0.4	0.3
QoS level(l_i)	0.6	0.7	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($l_i*d_i*x_i$)	360	5250	3300
Total capacity used($\sum l_i*d_i*x_i$)		8910	
Profit per service (($\alpha_i+\beta_i*l_i$)*p_i*x_i)	27	405	135
Total profit ($\sum$ ($\alpha_i+\beta_i*l_i$)*p_i*x_i		567	

With LINGO 11.0, we obtain the optimal solution of 567 from the three services provided. In Table 3, we can see that service 2 uses more capacity of 5250 compared to other services. From the three services, there exist 8910 kbps of total bandwidth or 64.7% of total bandwidth provided.

Tabel 4. Optimal Solution of Case 1 for $l_j < l_{j-1}$

Solution for $l_j < l_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.1	0.5	0.6
Premium quality (β_i)	0.8	0.3	0.3
Share of total network capacity(a_i)	0.2	0.4	0.3
QoS level(l_i)	0.9	0.8	0.6
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($l_i*d_i*x_i$)	540	6000	1980
Total capacity used($\sum l_i*d_i*x_i$)		8520	
Profit per service (($\alpha_i+\beta_i*l_i$)*p_i*x_i)	23.4	351	117
Total profit ($\sum$ ($\alpha_i+\beta_i*l_i$)*p_i*x_i		491.4	

Table 4 depicts the optimal solution of case 1 with $l_j < l_{j-1}$ of 491.4. In this solution, the total capacity used is 8520 kbps or 61.8 % from total capacity provided for three services. Service 2 consumes capacity of 6000 kbps.

Tabel 5. Solver Status of Case 1 by Modifying Base Price

Solver Status	$\alpha_i = \alpha_{i-1}$	$\alpha_i > \alpha_{i-1}$	$\alpha_i < \alpha_{i-1}$
Model Class	MINLP	MINLP	MINLP
State	Local Optimal	Local Optimal	Local Optimal
Objective	504	630	504
Infeasibility	0	$5.55\text{x } 10^{-17}$	0
Iterations	13	13	13
Extended Solver Status			
Solver Type	Branch and Bound	Branch and Bound	Branch and Bound
Best Objective	504	630	504
Objective Bound	504	630	504
Steps	0	0	0
Update Interval	2	2	2
Generated Memory Used(K)	27	28	28
Elapsed Time(S)	0	1	0

Table 5 above shows the solver status by modifying the base price. The best optimal solution is maximum total profit ISP can obtain. In Table 6, for case 1 for $\alpha_j = \alpha_{j-1}$, First and third solutions has the same solutions of 504 and The second solution is 630. We got maximum profit in service 2. By modifying $\alpha_j > \alpha_{j-1}$ service 2 achieve maximum total profit as Table 7 shows. So ISP has a choice to maximize the revenue.

Tabel 6. Optimal Solution of Case 1 for $\alpha_j = \alpha_{j-1}$

Solutions for $\alpha_j = \alpha_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.2	0.4	0.5
Premium quality (β_i)	0.8	0.4	0.3
Share of total network capacity(a_i)	0.2	0.5	0.3
QoS level(l_i)	0.8	0.9	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($l_i*d_i*x_i$)	480	6750	3300
Total capacity used($\sum l_i*d_i*x_i$)		10530	
Profit per service ($(\alpha_i+\beta_i*l_i)*p_i*x_i$)	24	360	120
Total profit ($\sum (\alpha_i+\beta_i*l_i)*p_i*x_i$		504	

The maximum profit of 504 is obtained with total capacity used of 10.530 kbps or 76.4% of provided total capacity for three services. Service 2 consumes the most capacity of 6750 kbps.

Tabel 7. Optimal Solution of Case 1 for $\alpha_j > \alpha_{j-1}$

Solutions for $\alpha_j > \alpha_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.3	0.6	0.7
Premium quality (β_i)	0.8	0.5	0.3
Share of total network capacity(a_i)	0.2	0.5	0.3
QoS level(l_i)	0.8	0.9	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($l_i*d_i*x_i$)	480	6750	3300
Total capacity used($\sum l_i*d_i*x_i$)	10530		
Profit per service ($(\alpha_i+\beta_i*l_i)*p_i*x_i$)	30	450	150
Total profit ($\sum (\alpha_i+\beta_i*l_i)*p_i*x_i$		630	

From Table 7 above, we can see that the optimal solution is 630 with the total capacity used of dengan 10.530 kbps or 76.4 % of total capacity provided. Service 2 consumes the most capacity of 6750 kbps.

Tabel 8. Optimal Solution of Case 1 for $\alpha_j < \alpha_{j-1}$

Solutions for $\alpha_j < \alpha_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.2	0.4	0.5
Premium quality (β_i)	0.8	0.4	0.3
Share of total network capacity(a_i)	0.2	0.5	0.3
QoS level(l_i)	0.8	0.9	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($l_i*d_i*x_i$)	480	6750	3300
Total capacity used($\sum l_i*d_i*x_i$)		10530	
Profit per service ($(\alpha_i+\beta_i*l_i)*p_i*x_i$)	24	360	120
Total profit ($\sum (\alpha_i+\beta_i*l_i)*p_i*x_i$		504	

In Table 8, maximum total profit of 504 is achieved with the used capacity is 10530 kbps or 76.4% of capacity provided to all services. Service 2 uses the most capacity of 6750 kbps with 10 users apply the service.

By modifying the quality premium, we have optimal solutions as follows.

Tabel 9. Solver Status of Case 1 by Modifying Quality Premium

Solver Status	$\beta_j = \beta_{j-1}$	$\beta_j > \beta_{j-1}$	$\beta_j < \beta_{j-1}$
Model Class	MINLP	MINLP	MINLP
State	Local Optimal	Local Optimal	Local Optimal
Objective	879	873	693
Infeasibility	1.11×10^{-16}	9.09×10^{-13}	1.11×10^{-16}
Iterations	12	12	12
Extended Solver Status			
Solver Type	Branch and Bound	Branch and Bound	Branch and Bound
Best Objective	879	873	693
Objective Bound	879	873	693
Steps	0	0	0
Update Interval	2	2	2
Generated Memory Used(K)	28	28	28
Elapsed Time(S)	0	0	0

Table 9 explains solver status of Case 1 by modifying quality premium. By modifying $\beta_j = \beta_{j-1}$ we obtain optimal solution of 879. So, to maximize ISP profit ISP can choose the scheme by setting up quality premium of $\beta_j = \beta_{j-1}$.

Tabel 10. Optimal Solution of Case 1 for $\beta_j = \beta_{j-1}$

Solutions for $\beta_j = \beta_{j-1}$			
Service	i=1	i=2	i=3
Base price(α_i)	0.5	0.6	0.6
Premium quality (β_i)	0.8	0.8	0.8
Share of total network capacity(a_i)	0.1	0.5	0.3
QoS level(I_i)	1	0.9	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service (I_i*d_i*x_i)	600	6750	3300
Total capacity used($\sum I_i*d_i*x_i$)		10650	
Profit per service ((α_i+β_i*I_i)*p_i*x_i)	39	630	210
Total profit ($\sum (\alpha_i+\beta_i*I_i)*p_i*x_i$		879	

Table 10 represents the optimal solution by modifying the quality premium with $\beta_j = \beta_{j-1}$. We got total profit of 879 with capacity used of 10650 or 77.3% from capcity provided by server. Service 2 used much capacity of 6750 kbps from capacity provided.

Tabel 11. Optimal Solution of Case 1 for $\beta_j > \beta_{j-1}$

Solutions for $\beta_j > \beta_{j-1}$			
Service	i=1	i=2	i=3
Base price(α_i)	0.5	0.7	0.6
Premium quality (β_i)	0.6	0.7	0.8
Share of total network capacity(a_i)	0.1	0.5	0.3
QoS level(I_i)	1	1	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service (I_i*d_i*x_i)	600	7500	3300
Total capacity used($\sum I_i*d_i*x_i$)	11400		
Profit per service ((α_i+β_i*I_i)*p_i*x_i)	33	630	210
Total profit ($\sum (\alpha_i+\beta_i*I_i)*p_i*x_i$		873	

From Table 11 above, we can see the maximum profit of 873 with total capacity used is 11,400 kbps or 82.7% of total capacity provided by server. Service 2 consumes much capacity compared to other services of 7500 kbps.

Tabel 12. Optimal Solution of Case 1 for $\beta_j < \beta_{j-1}$

Solutions for $\beta_j < \beta_{j-1}$			
Service	i=1	i=2	i=3
Base price(α_i)	0.3	0.5	0.6
Premium quality (β_i)	0.8	0.7	0.5
Share of total network capacity(a_i)	0.2	0.5	0.3
QoS level(I_i)	1	0.8	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service (I_i*d_i*x_i)	600	6000	3300
Total capacity used($\sum I_i*d_i*x_i$)		9900	
Profit per service ((α_i+β_i*I_i)*p_i*x_i)	33	495	165
Total profit ($\sum (\alpha_i+\beta_i*I_i)*p_i*x_i$		693	

Table 12 represents the optimal solutions from all services by modifying the quality premium. Total profit of 693 has been achieved with total capacity use of 9900 kbps atau or 71.8% from total capacity provided by server. Service 2 used much capacity of 600 kbps.

Next, for case 2, we also modify the model by setting up to vary or fix the index quality and base price to maximize the profit. For case 2, we do not modify the quality premium since in case 2, the quality premium has been fixed as a parameter.

Tabel 13. Solver Status of Case 2 by Modifying *index quality*

Solver Status	$I_j = I_{j-1}$	$I_j > I_{j-1}$	$I_j < I_{j-1}$
Model Class	MINLP	MINLP	MINLP
State	Local Optimal	Local Optimal	Local Optimal
Objective	537	525.6	410.4
Infeasibility	9.09×10^{-13}	5.55×10^{-17}	9.82×10^{-13}
Iterations	12	12	12
Extended Solver Status			
Solver Type	Branch and Bound	Branch and Bound	Branch and Bound
Best Objective	537	525.6	410.4
Objective Bound	537	525.6	410.4
Steps	0	0	0
Update Interval	2	2	2
Generated Memory Used(K)	26	26	26
Elapsed Time(S)	0	0	0

Table 13 represents the solver status of case 2 by modifying the index quality. The maximum profit is when the case $I_j = I_{j-1}$ occurs with total profit of 537. So, if ISP would like to reach its goal to maximize the profit, then the pricing scheme that can be adopted is $I_j = I_{j-1}$ pricing scheme.

Tabel 14. Optimal Solution of Case 2 for $I_j = I_{j-1}$

Solutions for $I_j = I_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.5	0.7	0.6
Share of total network capacity(a_i)	0.2	0.5	0.3
QoS level(I_i)	1	0.9	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($I_i*d_i*x_i$)	600	6750	3300
Total capacity used($\sum I_i*d_i*x_i$)	10650		
Profit per service (($\alpha_i+\beta*I_i$)*p_i*x_i)	21	396	120
Total profit ($\sum$ ($\alpha_i+\beta*I_i$)*p_i*x_i)		537	

In Table 14, total capacity used for all services is 10650 kbps or 77.3% from total capacity provided by server. The used capacity is achieved most in service 2 with 6500 kbps of total capacity provided 48.8% of total capacity for service 2.

Tabel 15. Optimal Solution of Case 2 for $I_j > I_{j-1}$

Solutions for $I_j > I_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.5	0.7	0.6
Share of total network capacity(a_i)	0.2	0.4	0.3
QoS level(I_i)	0.6	0.8	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service ($I_i*d_i*x_i$)	360	6000	3300
Total capacity used($\sum I_i*d_i*x_i$)	9660		
Profit per service (($\alpha_i+\beta*I_i$)*p_i*x_i)	18.6	387	120
Total profit ($\sum$ ($\alpha_i+\beta*I_i$)*p_i*x_i)		525.6	

Total profit of 525.6 is achieved with total capacity used of 9660 kbps or 70.1% of total capacity provided as stated in Table 15. Service 2 used highest capacity of 6000 kbps and 10 users apply the service.

Tabel 16. Optimal Solution of Case 2 for $l_j < l_{j\text{-}1}$

Solutions for $l_j < l_{j\text{-}1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.3	0.5	0.6
Share of total network capacity(a_i)	0.3	0.4	0.3
QoS level(l_i)	0.9	0.7	0.6
No. of concurrent users(x_i)	10	10	10
Used capacity per service (l_i*d_i*x_i)	540	5250	1980
Total capacity used($\sum l_i*d_i*x_i$)		7770	
Profit per service (($\alpha_i+\beta*l_i$)*p_i*x_i)	14.4	288	108
Total profit ($\sum (\alpha_i+\beta*l_i)*p_i*x_i$)		410.4	

From Table 16 above, we obtain total profit of 410.4. Total capacity used is 7770 kbps or 56.4% from capacity provided by server and service 2 uses highest capacity of 5250 kbps with 10 users

Tabel 17. Solver Status of Case 2 by Modifying *base price*

Solver Status	$\alpha_j = \alpha_{j\text{-}1}$	$\alpha_j > \alpha_{j\text{-}1}$	$\alpha_j < \alpha_{j\text{-}1}$
Model Class	MINLP	MINLP	MINLP
State	Local Optimal	Local Optimal	Local Optimal
Objective	441	516	481.8
Infeasibility	9.09×10^{-13}	9.09×10^{-13}	5.55×10^{-17}
Iterations	12	12	12
Extended Solver Status			
Solver Type	Branch and Bound	Branch and Bound	Branch and Bound
Best Objective	441	516	481.8
Objective Bound	441	516	481.8
Steps	0	0	0
Update Interval	2	2	2
Generated Memory Used(K)	26	26	26
Elapsed Time(S)	0	0	0

From Tabel 17 above, we got solver status for each modification of case 2. Highest profit is reached when we set up $\alpha_j > \alpha_{j\text{-}1}$. If ISP would like to achieve its goal, then IPS should conduct market competition and to get the customers by adopting this scheme by modifying $\alpha_j > \alpha_{j\text{-}1}$.

Tabel 18. Optimal Solution of Case 2 for $\alpha_j = \alpha_{j\text{-}1}$

Solutions for $\alpha_j = \alpha_{j\text{-}1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.5	0.5	0.5
Share of total network capacity(a_i)	0.1	0.5	0.3
QoS level(l_i)	1	1	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service (l_i*d_i*x_i)	600	7500	3300
Total capacity used($\sum l_i*d_i*x_i$)	11400		
Profit per service (($\alpha_i+\beta*l_i$)*p_i*x_i)	21	315	105
Total profit ($\sum (\alpha_i+\beta*l_i)*p_i*x_i$)		441	

In case 2 of Table 18, by modifying base price we have total profit of 441 with total capacity used of 11,400 kbps or 82.7% of total capacity provided by server. Again, service 2 consumes highest capacity used of 7500 kbps.

Tabel 19. Optimal Solution of Case 2 for $\alpha_j > \alpha_{j\text{-}1}$

Solutions for $\alpha_j > \alpha_{j\text{-}1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.5	0.6	0.7
Share of total network capacity(a_i)	0.1	0.5	0.3
QoS level(l_i)	1	1	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service (l_i*d_i*x_i)	600	7500	3300
Total capacity used($\sum l_i*d_i*x_i$)	11400		
Profit per service (($\alpha_i+\beta*l_i$)*p_i*x_i)	21	360	135
Total profit ($\sum (\alpha_i+\beta*l_i)*p_i*x_i$)		516	

Table 19 above explains the solution of case 2 by modifying $\alpha_j > \alpha_{j-1}$ to get optimal profit of yang 516. Total capacity used is 11400 kbps or 82.7% from total capacity provided. Service 2 serve highest capacity used with amount of 7500 kbps.

Tabel 20. Optimal Solution of Case 2 for $\alpha_j < \alpha_{j-1}$

Solutions for $\alpha_j < \alpha_{j-1}$			
Service	***i*=1**	***i*=2**	***i*=3**
Base price(α_i)	0.7	0.6	0.5
Share of total network capacity(a_i)	0.2	0.5	0.3
QoS level(I_i)	0.8	0.9	1
No. of concurrent users(x_i)	10	10	10
Used capacity per service (I_i*d_i*x_i)	480	6750	3300
Total capacity used($\sum I_i*d_i*x_i$)	10530		
Profit per service (($\alpha_i+\beta*I_i$)*p_i*x_i)	25.8	351	105
Total profit ($\sum (\alpha_i+\beta*I_i)*p_i*x_i$)		481.8	

Last table, Table 20 depicts the total profit of 481.8 with total capacity of 10530 kbps or 76.4% from total capacity provided. Again, service 2 reaches the highest total capacity used of 6750 kbps.

From Table 1-20, we can see that maximum profit is achieved when we modify the quality premium of case 1 with $\beta_j = \beta_{j-1}$ to yield total profit of 879. If ISP would like to reach its target then ISP should adopt that pricing scheme model in multiservice networks by varying base price as a variable and fixing quality premium as a constant.

4. Conclusion

The improved models by modifying the index quality, base price dan quality premium can yield the optimal solution using LINGO 11.0 then we proceed the solution to be analyzed theoretically. The results show that the connection between QoS level, number of capacity used and capacity provided by server. With the best pricing scheme, ISP is able to reach the target to maximize revenue and maintain best quality to the users.

In these new improved models, we obtain new parameters, additional variables and additional constraints that fit with each improved models. We got better profit compared to previous works. The cases we created are basically based on ISP goals to set up the base price, quality of service and QoS level.

For further research, we can try to generalize more services to be offered in order to work with real dynamic network in multiservice networks.

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#1801 Summary

SUMMARY REVIEW EDITING

Submission

Authors	Fitri Maya Puspita
Title	Model and Optimal Solution of Single Link Pricing Scheme Multiservice Network
Original file	1801-4831-1-SM.DOCX 2013-10-19
Supp. files	None ADD A SUPPLEMENTARY FILE
Submitter	Fitri Maya Puspita
Date submitted	October 19, 2013 - 09:03 AM
Section	Telecommunication
Editor	Sunardi Sasmowiyono Leo P. Ligthart Youssef Said (Review) Surinder Singh (Review) Dr. Linawati (Review) Lunchakorn Wuttisittikulkij (Review)
Author comments	This paper gives critical information on how ISP deals with current internet situation. The improved models can gives ISP information to adopt suitable scheme in multiservice networks.

Author Fees

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Title and Abstract

Title	Model and Optimal Solution of Single Link Pricing Scheme Multiservice Network
Abstract	*This paper discussed the new improved and modified internet pricing scheme in multiservice networks [1]. This new improved scheme is created to set up the base price, quality premium and Quality of service (QoS). This scheme has the purposes to help Internet Service Provider (ISP) in maximizing the revenue and contribute better quality of service to the users. The objective function will be formed to set up the base price and quality premium as a vaiable or a constant. The models used are in nonlinear forms and solved by using LINGO 11.0 to get the optimal solution. The results show that for each cases of improved scheme, ISP gets better optimal solutions by varying or fixing the base price and quality premium.*

Indexing

Keywords	internet pricing, quality of service, internet service provider, base price, quality premium
Language	en

Supporting Agencies

Agencies	—

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