

Network Protection through Insurance: Premium Computation for the ON-OFF Service Model

Loretta Mastroeni Maurizio Naldi

Università di Roma Tre · Università di Roma “Tor Vergata”

DRCN

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The risk of SLA commitments

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

Conclusions

The risk of SLA commitments

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Can the network provider protect itself through insurance ?

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Can the network provider protect itself through insurance ?

How much should it pay for insurance ?

Contents

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

Conclusions

Contents

- ▶ The service model

Contents

- ▶ The service model
- ▶ Quality metrics and losses

Contents

- ▶ The service model
- ▶ Quality metrics and losses
- ▶ Insurance premium computation

The service model

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

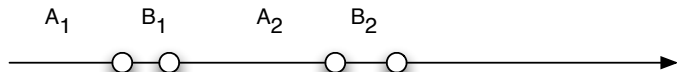
Conclusions

The service model

The service alternates between availability and non-availability, with sojourn times independent of each other

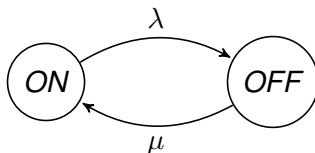
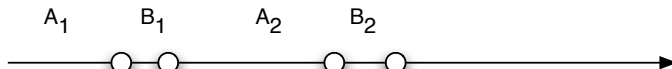
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Metrics for service quality

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

Conclusions

Metrics for service quality

- ▶ Number of failures

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- ▶ Number of outages lasting more than a prescribed threshold (long outages)

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Compensation is proportional to a quality metric

Example of compensation

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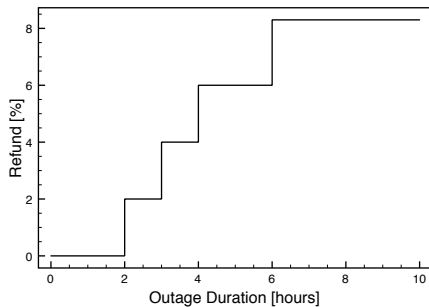
Introduction

Service model

Premium

Conclusions

Example of compensation



Economical loss

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

Conclusions

Economical loss

Assumption: the duration of failures is negligible with respect to the working times

Quality Metric	Loss	Avg	Variance
Failures	$k_f N_T$	$k_f \lambda T$	$k_f^2 \lambda T$
Long outages	$k_{lf} \sum_{i=0}^{N_T} I_{[B_i > W]}$	$k_{lf} \lambda T e^{-\mu W}$	$k_{lf}^2 \lambda T e^{-\mu W}$
Unavailability	$k_u \sum_{i=1}^{N_T} B_i$	$k_u \frac{\lambda T}{\mu}$	$2k_u^2 \frac{\lambda T}{\mu^2}$

The premium principle

The expected utility approach

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For a network provider, with assets ω , which faces a possible monetary loss X , the maximum tolerable insurance premium P^+ is the solution of the equilibrium equation

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$$r(x) = -\frac{u''(x)}{u'(x)}$$

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We define the risk aversion behaviour of the network provider by the coefficient

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The solution is

$$P^+ \simeq \mathbb{E}[X] + \frac{\mathbb{V}[X]}{2} r(\omega - \mathbb{E}[X])$$

The CARA property

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

Conclusions

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- ▶ The premium becomes $P^+ \simeq \mathbb{E}[X] + \alpha \frac{\mathbb{V}[X]}{2}$

Premium computation

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

Conclusions

Premium computation

Quality Metric	Premium
Failures	$P_f^+ = k_f \frac{T}{MTTR} \frac{1-\Phi}{\Phi} \left(1 + \frac{\alpha}{2} k_f\right)$
Long outages	$P_{lf}^+ = k_{lf} \frac{T}{MTTR} \frac{1-\Phi}{\Phi} e^{-\mu W} \left(1 + \frac{\alpha}{2} k_{lf}\right)$
Unavailability	$P_u^+ = k_u \frac{1-\Phi}{\Phi} T \left(1 + \alpha k_u MTTR\right)$

Example of premium trend

Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

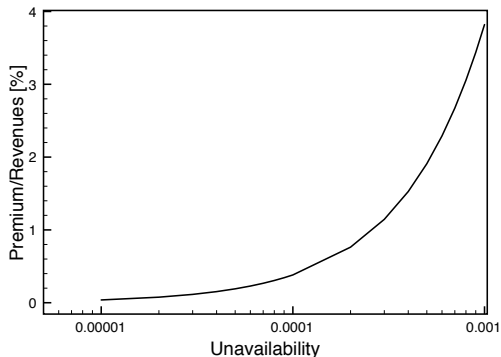
Conclusions

Example of premium trend

- ▶ Unit loss per hour = 1% of the annual revenues
- ▶ Monthly revenues = 20\$ flat
- ▶ Reference period $T = 1$ month
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Network insurance

Mastroeni-Naldi

Introduction

Service model

Premium

Conclusions

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Network insurance is viable and should be considered as an additional device to reduce risk