Are you being served: A Framework to manage Cloud outage repair times for Small Medium Enterprises

Jonathan Dunne, David Malone

ISSC2016 – 21st June

Hamilton Institute

Maynooth University
National University of Ireland Maynooth

Agenda:

1. Introduction
2. Background Research
3. Dataset
4. Analysis
5. Results
6. Conclusion

Introduction

- Software as a service (SaaS) is a software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted.
- Small to medium enterprises (SME’s) represent 79% of all employment with the EU. Annual turnover in excess of €440 billion.
- Nine out of ten SME’s in Europe have less than ten employees, which makes servicing of cloud outages a non-trivial effort.
- SME’s need a framework which can best utilise their limited operations resources to service system outages
- The core idea of our framework is to outline which outages types contribute to higher service times.

Background Research

- Software as a Service
  - Key evangelists:
- Major Cloud Outage events in 2015
  - Verizon (40 hours offline)
  - iCloud (12 & 7 hours)
  - Windows Azure (2 hours)
  - Starbucks (2 hours)
  - Google (Multiple. < 1 hour)
- Related Studies
  - Kleyner & O'Connor : Outage times for repairable systems can be best modeled with a log-normal distribution

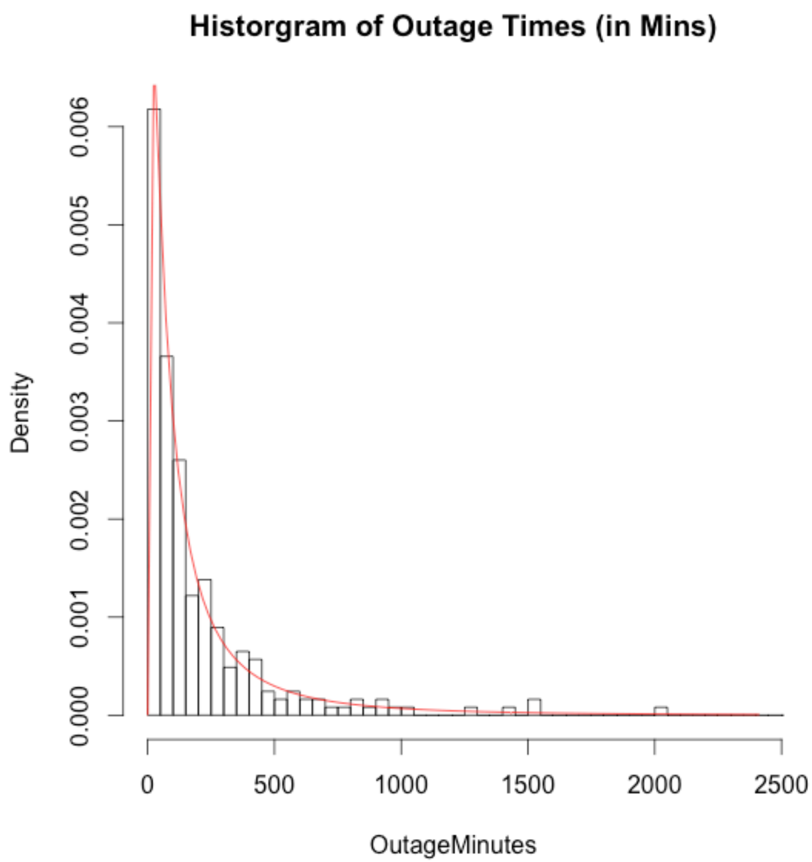
Data Set

- Our study collected data from:
  - 250 outage reports from a large cloud based system.
  - Data was collected over a 12-month period (Jan - Dec)
  - Four main components: Business support System (BSS) Collaboration, Email and Social.
  - Three data centres deployed globally.

- Reviewing the data, the following questions needed answering:
  - How are the times of cloud outage events distributed ?
  - Does the distribution vary by component?
  - Does the distribution differ by failure category?
  - Does the relationship differ by data centre ?

Analysis – Outage Distribution

- Fig. I shows the distribution of total outages events



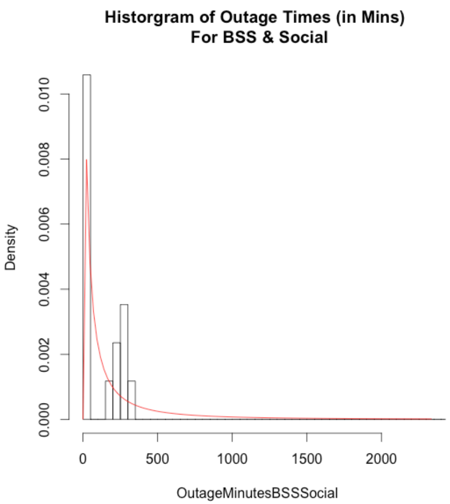
Summary Statistics:

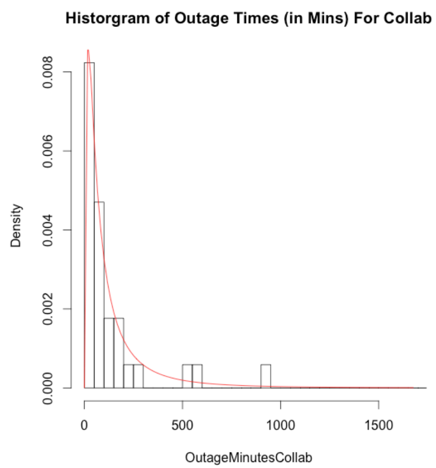
Samples = 246
Mean = 314.14
Std Dev = 1414.43
Median = 105
Skew = 13.80

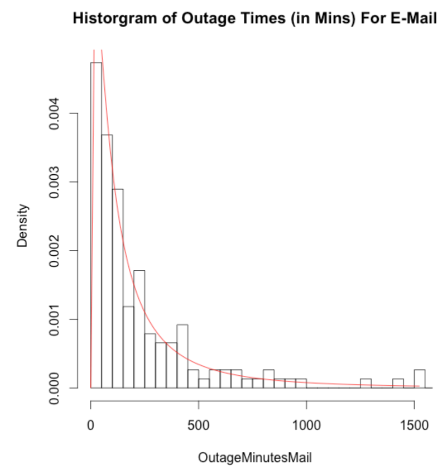
Distribution = Log Normal
AD Test statistic = 0.29
p-value = 0.95
.

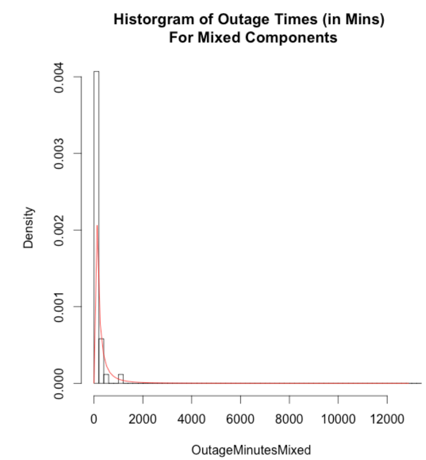
Analysis – Distribution by Component

Fig. 2 shows the distribution of outage events by component: BSS-Social, Collaboration, Mail and Mixed component (More than 2 components).









BSS-Social Statistics:

Samples = 17
Mean = 274.23
Std Dev = 639.44
Median = 45
Skew = 3.56

Distribution = Log Normal
Anderson Darling GOF
AD = 0.555, p-value = 0.690

Collaboration Statistics:

Samples=34
Mean = 189
Std Dev = 379.33
Median = 61.5
Skew = 3.83

Distribution = Log Normal
Anderson Darling GOF
AD = 0.633, p-value = 0.616

Mail Statistics:

Samples= 152
Mean = 258.10
Std Dev = 423.27
Median = 126.5
Skew = 5.45

Distribution = Log Normal
Anderson Darling GOF
AD = 0.180, p-value = 0.995

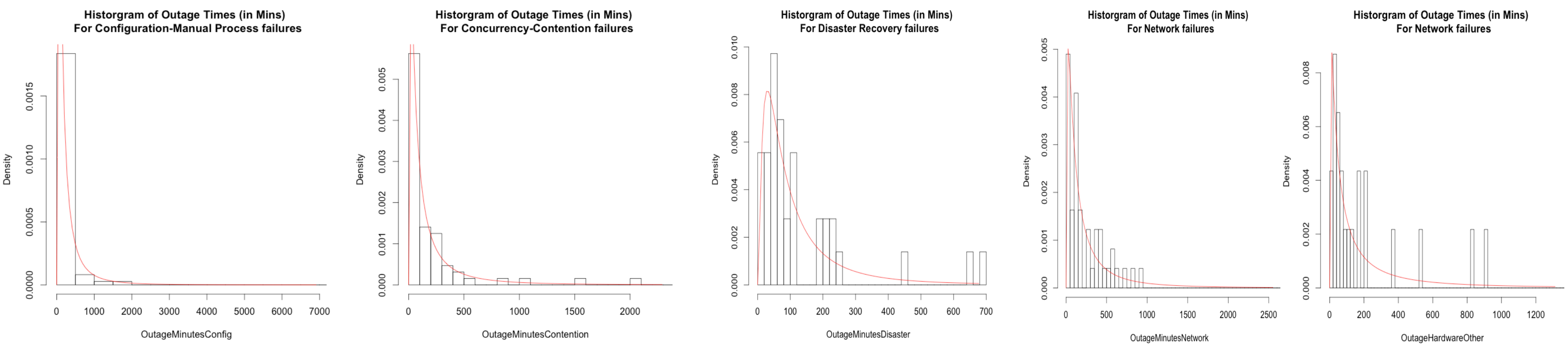
Mixed Component Statistics:

Samples=43
Mean = 626.95
Std Dev = 3260.78
Median = 85
Skew = 6.30

Distribution = Log Normal
Anderson Darling GOF
AD = 0.608, p-value = 0.639

Analysis – Distribution by Failure Type

Fig. 4 shows the distribution of outage events by type: Configuration-Manual Process, Contention-Concurrency, Disaster Recovery, Network and Hardware-Other.



Configuration-Manual Statistics:

Samples = 74
Mean = 488.61
Std Dev = 2488.21
Median = 114.5
Skew = 8.28

Distribution = Log Normal
Anderson Darling GOF
AD = 0.331, p-value = 0.913

Contention-Concurrency Statistics:

Samples = 64
Mean = 238.78
Std Dev = 468.62
Median = 86
Skew = 3.69

Distribution = Log Normal
Anderson Darling GOF
AD = 0.248, p-value = 0.971

Disaster Recovery Statistics:

Samples = 36
Mean = 134.03
Std Dev = 160.72
Median = 72
Skew = 2.33

Distribution = Log Normal
Anderson Darling GOF
AD = 0.293, p-value = 0.943

Network Statistics:

Samples = 49
Mean = 314.59
Std Dev = 590.74
Median = 145
Skew = 5.30

Distribution = Log Normal
Anderson Darling GOF
AD = 0.491, p-value = 0.756

Hardware-Other Statistics:

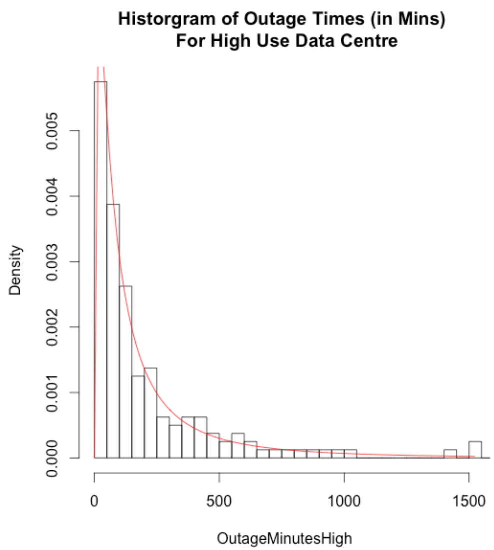
Samples = 23
Mean = 243.44
Std Dev = 357.54
Median = 91
Skew = 2.11

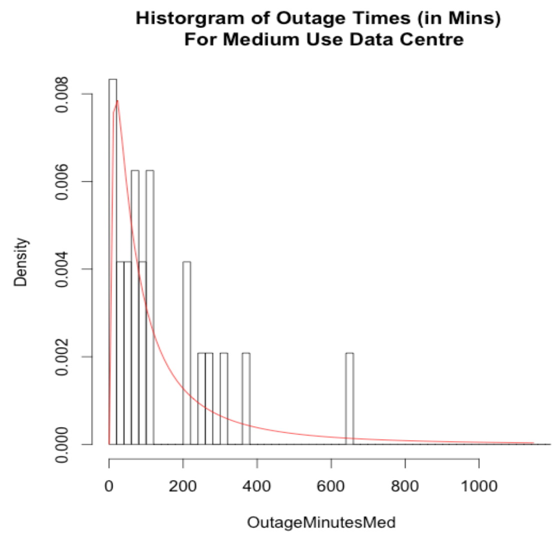
Distribution = Log Normal
Anderson Darling GOF
AD = 0.275, p-value = 0.956

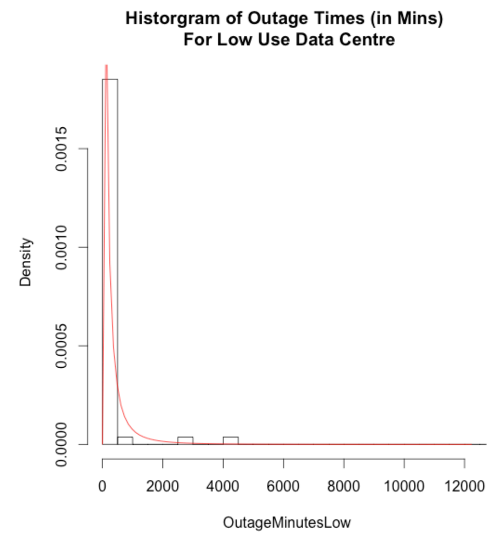
% Of Total	30%	26%	15%	20%	9%

Analysis – Distribution by Data Centre

Fig. 3 shows the distribution of outage events by Data Centre: High, Medium, Low use.







Data Centre (A) High Use Statistics:

Samples = 160
Mean = 224.43
Std Dev = 312.83
Median = 113.5
Skew = 2.93

Distribution = Log Normal
Anderson Darling GOF
AD = 0.177, p-value = 0.995

Data Centre (B) Medium Use Statistics:

Samples = 24
Mean = 187.67
Std Dev = 279.97
Median = 89.5
Skew = 2.89

Distribution = Log Normal
Anderson Darling GOF
AD = 0.215, p-value = 0.986

Data Centre (C) Low Use Statistics:

Samples = 54
Mean = 645.39
Std Dev = 2961.09
Median = 79.5
Skew = 6.67

Distribution = Log Normal
Anderson Darling GOF
AD = 1.085, p-value = 0.316

Analysis – Regression testing for Correlation

- The purpose of the Regression analysis is to understand if there is a relationship between outage times and other factors. (e.g. Data centre, component or outage type)

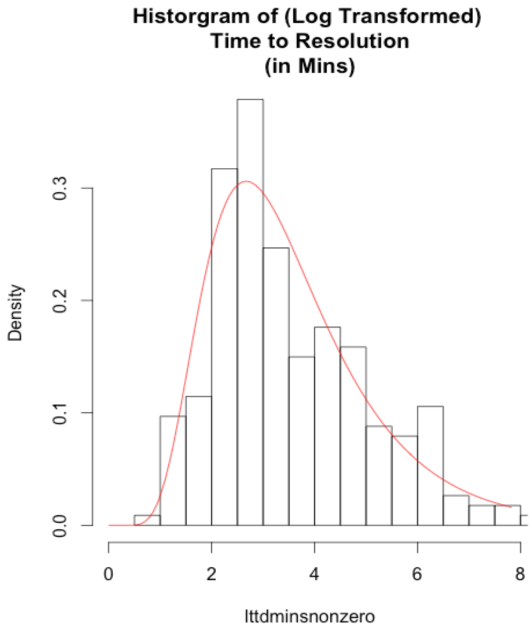
Key findings:

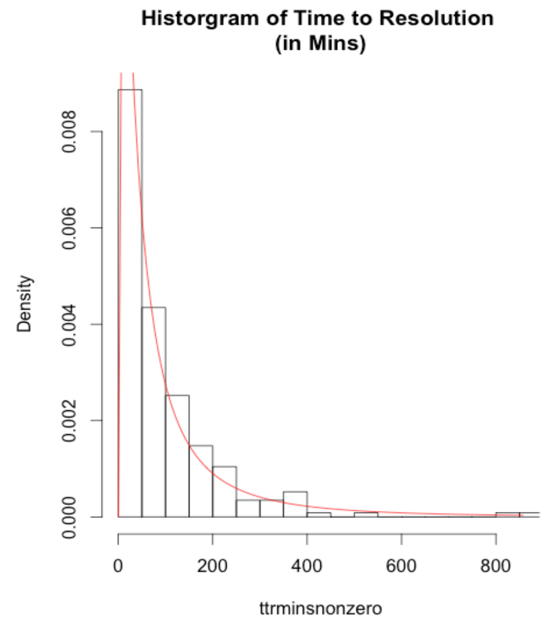
- Outage times are strongly correlated with the E-mail component.
- Outage times are less strongly correlated to both the BSS components and network outages type outages.
- For all other variables there was little evidence of correlation.

Data Centre	Regression effect	p value	Component	Regression effect	p value	Trigger Type	Regression effect	p value
B	Little	0.651	BSS	Weak	0.075	Config-Manual	Little	0.473
C	Little	0.513	Collaboration	Little	0.164	Concurrence-Contention	Little	0.228
A	Little	0.72	Email	Strong	0.008	Disaster Recovery	Little	0.218
Mixed	Little	0.234	Mixed Component	Little	0.172	Hardware-Other	Little	0.723
			Social	Little	0.928	Network	Weak	0.06

Note: The Lower the P value the higher the level or association / correlation.

Analysis – TTD Vs TTR





TTD Statistics (Untransformed):

Samples = 229
Mean = 228.81
Std Dev = 1450.44
Median = 24
Skew = 13.57

TTD Statistic (Log Transformed)
Distribution =Log Normal
AD = 0.83, p-value = 0.46

TTR Statistics:

Samples = 230
Mean = 108.25
Std Dev = 162.50
Median = 59
Skew = 4.75

Distribution = Log Normal
Anderson Darling GOF
AD = 0.79, p-value = 0.50

Results

- Outage Distribution:
  - Overall outage times can be successfully modeled by a log normal distribution
  - The distribution is skewed which suggest great variability in service times.

- Component:
  - Mean outage times vary by component. Collaboration outages recorded the shortest mean outage times, with BSS & Social the longest.
  - Operations teams can be elastic in size to target specific components on a per outage basis.

- Data Centre:
  - Mean outage times vary by component. Medium use data centres recorded the longest mean outage times, with Low usage the longest.
  - Operations teams should standardize problem determination techniques to ensure uniform resolution times.

- Failure Type:
  - Mean outage times vary significantly by failure type. Configuration-Human error and Network outages take the longest to resolve.
  - Investing in best of breed automation assets and state of the art monitoring will significantly reduce configuration issues while providing more awareness of network health.

Conclusion

- Our study has shown:
  - The log normal distribution is an effective method to model cloud outage events repair times.
  - Outage event data can be used to create outage event resolution frameworks.
  - Our framework will allow operation teams to focus on specific outage events and rapidly reduce their remediation times.