

# Appendix A

## Online Survey

### Summary

In this appendix the reader is presented with specific information regarding the online survey. The author would like to point out that the survey questions appearing in this appendix forms part of the survey's background information, hence its exclusion from *Chapter Three*. In addition to these survey questions this appendix also contains an illustration of the online survey as it appeared to the respondents during the survey process.

**Table A.1:** Usage of cloud computing services

#	Survey question	Purpose of question
1	Is your university officially making use of third party cloud computing services?	The literature, specifically the survey conducted by Appirio [1], found that the views and perceptions of survey participants post cloud adoption differed from those who have not adopted the cloud. The aim of this question is to ascertain how prevalent cloud adoption is amongst South African universities. Designed as a filter question respondents will be given a choice between "yes" or "no", which will enable the survey to ask relevant follow up questions, as suggested by Dilman, Smyth and Christian [29, page 80]. [By selecting "yes" respondents are directed to question three with a selection of "no" directing them to question six.]
2	Please specify which third party cloud computing providers your university is currently making use of and whether they are being used as SaaS, PaaS or IaaS services or any combination thereof.	After answering "yes" to question two respondents will be directed to this question. The purpose of this question is to ascertain the various types of clouds that are being used as well as in which architectural models they are currently being used. The various cloud models that form an integral part of cloud architecture is discussed in Section 2.2 of the literature review.
4	In which of the following functional areas does your university use third party cloud services? You may select multiple options if applicable	It is anticipated that different functional areas will be assigned varying levels of priority, sensitivity as well as levels of acceptable risk. The purpose of this question is to ascertain where the cloud services are being used. Although cloud computing risks is outside the scope of this study, answers to this question could possibly be used in the construction of relevant follow-up questions.
5	Which of the following user populations, within your university, have exerted the most pressure to move towards the cloud?	Some studies discussed in the literature review (see Section 2.8) suggest that business (instead of IT) is the major driving force behind the move towards the cloud, especially in the private sector. The purpose of this question is to ascertain which group of university computer users are providing the same driving force behind a move towards the cloud, if any.
6	Please indicate, from the options listed below, why your university has avoided making use of third party cloud computing services. You may select multiple options if applicable.	The purpose of this question is to understand to which extent the university key stakeholders' reasons for not adopting the cloud correspond with that of the surveys that are discussed in the literature (see Section 2.8).
7	Which of the following user populations, within your university, have exerted the most pressure not to move towards the cloud?	This question is related to question five and aims to understand which group of university computer users is resisting a move towards the cloud the most.

**Table A.2:** Cloud computing architecture

#	Survey question	Purpose of question
13	Rate your level of experience with regard to the following architectural aspects of cloud computing.	The purpose of this question is to get an idea of how familiar the respondents are with specific cloud computing models. If they have little experience with these models interview questions would have to accommodate that fact. To aid the respondent several definitions have been provided in case they are not familiar with the terminology used in the literature.

Table A.3: Demographics and context

#	Survey question	Purpose of question
8	How much international bandwidth does your university have access to at its main administrative campus?	The purpose of this question is technical in nature, but yet also contextual. Because availability is a key concern when considering a move towards the cloud, ample bandwidth becomes important. Specifically international bandwidth. Universities with access to similar amounts of bandwidth could be compared.
9	Is your university connected to the S <sup>4</sup> NReN network?	Another key contextual question. The purpose here is to find out in which way the survey answers of universities with no SANReN connection differ from those universities that do have a connection to the SANReN network. Also, are the survey answers of SANReN connected universities consistent.
15	Approximately how many users (students and staff members) access your university network?	The purpose of this question is to put the previous answers into perspective and to give the researcher some ability to compare universities with similar size user populations.
16	Approximately how many users access your university network remotely via a VPN connection?	This a contextual question, which will indicate whether or not there are additional factors to consider with regard to the availability of the cloud, since these users pose an additional security risk.
17	How many campuses does your university have?	This question intends getting another perspective on the size of the respondent's university, but from a geographical point of view. It links up with question sixteen in that many of these campuses were once part of other institutions and may or may not have very different requirements and views on cloud computing.
18	Approximately how many full-time IT staff members (including IT staff members within academic departments) does your university employ?	Another question relating to the context and size of the university in question. Larger IT departments may have staff members dedicated to network and information security, which will influence the views and perceptions of senior management provided that they communicate effectively with these technical security staff member/s.
19	What is your current job description?	The respondent might have a unique title bringing with it a host of unique ways in which to view cloud computing.
20	Has your university merged or split with other universities?	Linking up with question thirteen the purpose of this question is to know whether or not there is a possibility of opposing, or in the least, varying views regarding cloud computing and its adoption, since staff members might still cling to the views of their previous university (i.e. before they merged or split up). Additionally Walsham [?] states that new information systems (like the use of the cloud) changes the interaction between users within organizations, which has an effect on the organizational context (of the university in this instance).

## VOLUNTARY QUESTIONNAIRE FOR KEY STAKEHOLDERS AT SOUTH AFRICAN UNIVERSITI...

*"Cloud Adoption in South Africa: A Higher Education Perspective on Information Security Concerns"*

**Researcher:** Mr Karl van der Schyff

**Supervisors:** Dr Barry Irwin & Mr Kirstin Krauss

**Department:** Department of Computer Science

**University:** Rhodes University

### **Purpose of this questionnaire:**

The primary objective of this questionnaire is to find out how the information security aspects highlighted in this questionnaire affect the adoption of cloud computing within South African universities.

### **Note to the participant:**

- We need your help to understand how information security concerns affect the adoption of cloud computing within South African universities.
- Although we would like you to help us, you do not have to take part in this survey.
- We have received ethical clearance from Rhodes University to conduct this survey.
- If you do not want to take part, just exit the questionnaire by clicking on the 'Exit this questionnaire' button in the top right-hand corner.
- What you say in this questionnaire will remain private and confidential. No one will be able to trace your opinions back to you as a person or to your institution.
- This questionnaire is hosted online by SurveyMonkey and should not take more than 10-15 minutes to complete.

### **How to complete the questionnaire:**

- Please answer the questions truthfully.
- To navigate the questionnaire once it has started please click on 'Next' to proceed to the next page in the questionnaire, 'Previous' to proceed to the previous page and 'Exit this questionnaire' located in the upper right corner to exit the questionnaire at any time.
- We prepared questions on topics you should feel comfortable with.

Please direct any questions with regard to this questionnaire and the study in general to: Karl van der Schyff (Researcher) or Kirstin Krauss (Supervisor)

**I hereby give permission that my responses may be used for research purposes provided that my identity is not revealed in the published record of the research.**

AGREE

DISAGREE

**Brief clarification of terms:**

In the context of this survey a cloud computing service is defined as a cloud-based application that is being used in place of a traditional on-site application. Examples include using Amazon EC2 as a cloud service to provide virtual machines instead of an on-site application such as Microsoft Hyper-V or Microsoft Office 365 instead of Microsoft Office 2010.

**Is your university officially making use of third party cloud computing services?**

YES

NO

**Brief clarification of terms:**

**Cloud Delivery Models:**

**Software-as-a-Service(SaaS):** Applications and services, like webmail and remote backup, are hosted with the cloud provider and made available to the customer over the Internet; usually via a web browser. Examples are GoogleApps, NetSuite and Dropbox.

**Platform-as-a-Service(PaaS):** In this delivery model developer tools are made available to PaaS clients, which allows for rapid application development in a homogeneous web environment. Examples are Windows Azure and Google AppEngine.

**Infrastructure-as-a-Service(IaaS):** With this cloud delivery model a client is able to rent a virtual machine image as a service or even a collection of virtualized servers organized into a virtual private data centre. This delivery model affords the client the most control of all the delivery models. Amazon EC2 is just one example.

**Please specify which third party cloud computing providers your university is currently making use of and whether they are being used as SaaS, PaaS or IaaS services or any combination thereof.**

	SaaS	PaaS	IaaS
3X Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Amazon Web Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AppRiver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barracuda	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Content Pro	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GoGrid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gordano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
McAfee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft Office 365	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Millenium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Netsuite	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rackspace	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sierra	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Windows Azure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**In which of the following functional areas does your university use third party cloud services? You may select multiple options if applicable.**

- Accounting & Financial Administration
- Application Development
- Calendaring
- Campus Administration
- Email
- Helpdesk
- Human Resources
- Legal
- Library
- Public Relations
- Research
- Student Administration
- Web Hosting
- Other (please specify)

**Which of the following user populations, within your university, have exerted the most pressure to move towards the cloud?**

- Academia
- IT department
- Library
- Management
- None
- Postgraduate students
- Undergraduate students
- Other (please specify)

**Please indicate, from the options listed below, why your university has avoided making use of third party cloud computing services. You may select multiple options if applicable.**

- Availability concerns
- Can't see the benefit
- Compliance concerns
- Disaster recovery concerns
- Financial concerns
- Information criticality concerns
- Information security concerns
- Integration concerns
- Internet bandwidth concerns
- Legal concerns
- Policy concerns
- Privacy concerns
- Staff skill-set concerns
- Vendor lock-in
- Vendor support concerns
- Other (please specify)

**Which of the following user populations, within your university, have exerted the most pressure not to move towards the cloud?**

- Academia
- IT Department
- Library
- Management
- None
- Postgraduate students
- Undergraduate students
- Other (please specify)

**Brief clarification of terms:**

**Multi-tenant:** Multi-tenancy is a concept where some of the cloud infrastructure supplied by the cloud provider is shared amongst multiple clients.

**Rate the importance of the following concepts with regard to cloud adoption.**

	Not at all important	Not very important	Neutral	Somewhat important	Very important
Ability to control a cloud infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to the SANReN network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost of broadband access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data retention after severing ties with cloud provider	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IT support at your location	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge of cloud computing threats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge of the security incident response life cycle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Monitoring capabilities of the cloud provider	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Physical location of cloud based data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prevention of cloud computing threats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security incident recovery in a multi-tenant cloud infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Service level agreement between client and cloud provider	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transparency of cloud provider operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**How much international bandwidth does your university have access to at its main administrative campus?**

- Less than 1 mbit
- Between 1 mbit and 5 mbits
- Between 6 mbits and 15 mbits
- Between 16 mbits and 25 mbits
- Between 26 mbits and 50 mbits
- Between 51 mbits and 100 mbits
- Between 101 mbits and 200 mbits
- Between 201 mbits and 300 mbits
- More than 300 mbits

**Is your university connected to the SANReN network?**

- NO
- YES

**Rate your level of experience with regard to the following cloud computing threats:**

	No experience	I have heard about it	I know the terminology	I know how to monitor for it	I know how to mitigate it
Account or service hijacking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Administrative abuse of cloud infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data loss or leakage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Denial of Service	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Insecure application programming interfaces (APIs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Malicious insiders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Traditional threats to networking (i.e. spoofing, man-in-the-middle attacks and ARP poisoning)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Virtualization or hypervisor based threats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Rate your level of experience with regard to the following cloud computing threat mitigation techniques and technologies:**

	No experience	I have heard about it	I know the terminology	I have used it in the past	I am currently using it
Access controls	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Backup technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloud monitoring technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Encryption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Log management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reporting within a cloud infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Specialized authentication mechanisms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Threat mitigation offerings from cloud providers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Virtualization based threat mitigation technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Please rank the following information security concerns in order of their susceptibility to cloud computing threats. A selection of 1 would indicate that the information security concern is most susceptible with a selection of 3 indicating it is least susceptible.**

**Please select one number for each rank.**

	1	2	3
Availability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Confidentiality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Integrity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate your level of experience with regard to the following architectural aspects of cloud computing (brief descriptions are provided to clarify our understanding of the various models):

**Cloud Deployment Models:**

**Community Cloud Computing:** In Community Cloud Computing resources are shared amongst a community or organizations that have the same or similar security and/or compliance requirements.

**Public Cloud Computing:** With Public Cloud Computing the services a user or organization accesses are hosted by a cloud provider that sells or rents out the same or similar cloud services to any person or organization in the general public.

**Private Cloud Computing:** In Private Cloud Computing the entire cloud infrastructure is owned by the organization allowing them to exercise full control over its operation.

**Hybrid Cloud Computing:** Hybrid Cloud Computing is simply a combination of both the public and private cloud deployment models. This enables a client, for example, to host sensitive data in the private cloud and less sensitive data in the public cloud.

**Cloud Delivery Models:**

**Software-as-a-Service(SaaS):** Applications and services, like webmail and remote backup, are hosted with the cloud provider and made available to the customer over the Internet; usually via a web browser. Examples are GoogleApps, NetSuite and Dropbox.

**Platform-as-a-Service(PaaS):** In this delivery model developer tools are made available to PaaS clients, which allows for rapid application development in a homogeneous web environment. Examples are Windows Azure and Google AppEngine.

**Infrastructure-as-a-Service(IaaS):** With this cloud delivery model a client is able to rent a virtual machine image as a service or even a collection of virtualized servers organized into a virtual private data centre. This delivery model affords the client the most control of all the delivery models. Amazon EC2 is just one example.

**Cloud computing enabling technologies:** These are technologies that make it possible to deliver cloud services in an economical and flexible manner. An example would be virtualization.

**Rate your level of experience with regard to the following architectural aspects of cloud computing:**

	No experience	I have heard about it	I know the terminology	I understand how it works	I am currently using it
Cloud computing delivery models	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloud computing deployment models	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloud computing enabling technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Please rate your level of experience with regard to the following aspects of security incident response in a cloud environment:**

	No experience	I have heard about it	I know the terminology	I have used it in the past	I am currently using it
Contractual service level agreements for security incident response	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forensic investigation of a cloud environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ISO 27001 best practise guidelines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Phases of the security incident response life-cycle (eradication and recovery)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security incident response in SaaS, PaaS or IaaS clouds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Approximately how many users (students and staff members) access your university network?**

- Less than 5000 users
- Between 5000 and 7500 users
- Between 7501 and 10000 users
- Between 10001 and 15000 users
- Between 15001 and 20000 users
- Between 20001 and 30000 users
- Between 30001 and 40000 users
- Over 40000 users

**Approximately how many users access your university network remotely via a VPN connection?**

- Less than 50
- Between 50 and 75 users
- Between 76 and 100 users
- Between 101 and 150 users
- Between 151 and 200 users
- Between 201 and 300 users
- Between 301 and 400 users
- Over 400 users

**How many campuses does your university have?**

- 1
- 2
- 3
- 4
- 5
- More than 5 (please specify how many)

**Approximately how many full-time IT staff members (including IT staff members within academic departments) does your university employ?**

- Less than 25
- Between 25 and 50
- Between 51 and 100
- Between 101 and 150
- More than 150 (please specify how many)

**What is your current job description?**

**Has your university merged or split with other universities?**

- NO
- YES (please elaborate)

**Thank you very much for completing this survey!**

If you wish to receive a summary of the research findings please get in contact with either the researcher or the supervisor.

**Researcher:** Kari van der Schyff

**Telephone:** 046-6038649

**Email:** [k.vanderschyff@ru.ac.za](mailto:k.vanderschyff@ru.ac.za)

**Supervisor:** Kirstin Krauss

**Telephone:** 046-6038380

**Email:** [k.krauss@ru.ac.za](mailto:k.krauss@ru.ac.za)

## **Appendix B**

# **Participant Correspondence**

### **Summary**

This appendix contains illustrations of the documents that facilitated participant correspondence. It starts by first showing the *pdf* document which was emailed to potential survey respondents, concluding with a copy of the letter of informed consent.

# VOLUNTARY QUESTIONNAIRE FOR KEY STAKEHOLDERS AT SOUTH AFRICAN UNIVERSITIES:

*“Cloud Adoption in South Africa: A Higher Education Perspective on Information Security Concerns”*

**Researcher:** Mr Karl van der Schyff  
**Supervisors:** Dr Barry Irwin & Mr Kirstin Krauss  
**Department:** Department of Computer Science  
**University:** Rhodes University

## **Purpose of this questionnaire:**

The primary objective of this questionnaire is to find out how the information security aspects highlighted in this questionnaire affect the adoption of cloud computing within South African universities.

## **Note to the participant:**

- We need your help to understand how information security concerns affect the adoption of cloud computing within South African universities.
- Although we would like you to help us, you do not have to take part in this survey.
- We have received ethical clearance from Rhodes University to conduct this survey.
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- What you say in this questionnaire will remain private and confidential. No one will be able to trace your opinions back to you as a person or to your institution.
- This questionnaire is hosted online by SurveyMonkey and should not take more than 10-15 minutes to complete.

## **How to complete the questionnaire:**

- Please answer the questions truthfully.
- To navigate the questionnaire once it has started please click on ‘Next’ to proceed to the next page in the questionnaire, ‘Previous’ to proceed to the previous page and ‘Exit this questionnaire’ located in the upper right corner to exit the questionnaire at any time.
- We prepared questions on topics you should feel comfortable with.

Please direct any questions with regard to this questionnaire and the study in general to the following email addresses: [k.vanderschyff@ru.ac.za](mailto:k.vanderschyff@ru.ac.za) (Researcher) or [k.krauss@ru.ac.za](mailto:k.krauss@ru.ac.za) (Supervisor)

To participate in this survey click on the link below:

**<https://www.surveymonkey.com/s/23ML6PR>**

**Thank you very much for participating in this survey!**

## INFORMED CONSENT

### Permission to use my responses for academic research

I hereby give permission that my responses may be used for research purposes provided that my identity is not revealed in the published record of the research

Initials and surname: \_\_\_\_\_

Postal Address: \_\_\_\_\_

Postal Code: \_\_\_\_\_

Contact Number: \_\_\_\_\_

Email Address: \_\_\_\_\_

Signature: \_\_\_\_\_

Would you like to receive a summary of the research findings when the project is completed?

Yes

No