

# **RESEARCH COLLABORATION AGREEMENT**

**BETWEEN**

**University of Cape Town**

**AND**

**African Network Information Centre (AfriNIC) Ltd**

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*RESEARCH COLLABORATION ON African Route-collectors Data Analyzer (ARDA)*

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## RESEARCH COLLABORATION AGREEMENT

**THIS RESEARCH COLLABORATION AGREEMENT** is made this 8th day of November 2021 (hereinafter referred to as "Agreement");

### BETWEEN

**University of Cape Town (UCT)**, a university incorporated in terms of the Higher Education Act, 1997, and the statute of the University of Cape Town, as published and gazetted on 24 January 2020 in Government Gazette No 41, 42967, herein represented by Nadia Ebrahim, in her capacity as Contracts Manager of the University of Cape Town and she being duly authorized thereto, having its principal place of business at Bremner Building, Lower Campus, Lovers' Walk, Rondebosch, 7700 (hereinafter referred to as "UCT") of the first part;

### AND

**African Network Information Centre (AfriNIC) Ltd**, conducted under the name "AFRINIC" (Company registration #: 49338 (registered in Mauritius) ), and having its business address at the 11th Floor, Standard Chartered Tower, Cybercity, Ebène, Mauritius (hereinafter referred to as "AFRINIC") of the second part.

(UCT and AFRINIC shall hereinafter be collectively referred to as "Parties" and individually as "Party", where the context so requires)

### WHEREAS

- A. University of Cape Town (UCT) is a higher education institution in Cape Town, South Africa. With its research and teaching facilities, experience, and a multi-disciplinary team of experts from among its staff members, UCT has entered into various collaborative arrangements with other parties in its efforts to enhance its research content and strengthen its industrial networking.
- B. AFRINIC is a nonprofit and member-based organisation registered and operating under the Corporate Legal Frameworks of Mauritius. As the Regional Internet Registry (RIR) for Africa and the Indian Ocean region, AFRINIC is responsible for the distribution and management of Internet number resources consisting of: (1) Internet Protocol (IP) address space (IPv4 and IPv6); (2) Autonomous System Numbers (ASNs).
- C. UCT and AFRINIC are of the view that there are synergistic benefits to be derived for the Parties in this collaboration through sharing and further developing the knowledge and expertise of both Parties in relation to the Project (as hereinafter defined).
- D. UCT and AFRINIC are desirous of formalizing this research collaboration by entering into this Agreement subject to the terms and conditions as stipulated herein.

**NOW IT IS HEREBY AGREED AS FOLLOWS:**

**1. DEFINITIONS AND INTERPRETATIONS**

In this Agreement, unless the context otherwise requires, the following terms shall have the following meaning: -

**“Background Intellectual Property”** means the pre-existing and/or background Intellectual Property owned or developed by UCT or AFRINIC independently, with no facilities, contribution, involvement or support by the other Party as to its development and any Intellectual Property developed outside the scope of this Agreement.

**“Effective Date”** means the date appearing at the beginning of this Agreement.

**“Force Majeure”** means events or circumstances beyond the reasonable control of either Party including but not limited to strikes, lock-outs or other labour disputes, civil commotion, war, act of terrorism, radiation or contamination from nuclear leak or combustion, epidemics, pandemics, embargoes, flood, earthquake, tsunamis and acts of God.

**“Intellectual Property”** means

- (a) Inventions; manner, method or process of manufacture; method or principle of construction; or design; plan, drawing or design; or scientific, technical or engineering information or document;**
- (b) Improvement, modification or development of any of the foregoing;**
- (c) Patent, application for a patent, right to apply for a patent or similar rights for or in respect of any intellectual Property referred to in paragraph (a) or (b);**
- (d) Trade secret, know-how, confidential information or right of secrecy or confidentiality in respect of any information or document or other intellectual Property referred to in paragraph (a) or (b);**
- (e) Copyright or other rights in the nature of copyright subsisting in any works or other subject matter referred to in paragraph (a) or (b);**

- (f) **Registered and unregistered trademark, registered design, application for registration of a design, right to apply for registration of a design or similar rights for or in respect of any work referred to in paragraph (a) or (b);**
  
- (g) **Any Intellectual Property in addition to the above which falls within the definition of intellectual property rights contained in Article 2 of the World Intellectual Property Organisation Convention of July 1967; and**
  
- (h) **Any other rights arising from intellectual activities in the scientific, literary or artistic fields.**

**“New Intellectual Property”** means the Intellectual Property jointly conceived, created, developed, improved or reduced to practice or writing by the Parties hereto as a result of the Project.

**“Project”** means the research collaboration project contemplated herein titled **‘African Route-collectors Data Analyzer (ARDA)’** as particularly described in Schedule A hereto.

## **2. COMMENCEMENT & TERM**

Regardless of the diverse dates the Parties may have signed this Agreement, the term of this Agreement shall be from the Effective Date until 31 December 2021 and the Agreement shall be renewed annually for a further two years, subject to an annual progress review. Any subsequent renewals must be agreed in writing.

## **3. ROLES AND RESPONSIBILITIES OF THE PARTIES**

In consideration of the covenants herein and subject to the terms of this Agreement and all applicable laws, the Parties shall carry out their respective roles and responsibilities in accordance with the provisions of this Agreement and within the scope of responsibilities as set out below.

### **3.1 UCT’s Roles and Responsibilities**

- (a) **STATEMENT OF WORK.** UCT agrees to use its best efforts to perform the Project as described in Appendix A hereto.
- (b) **FACILITIES.** UCT will provide the utilities and office, laboratory and field space needed for the Project.
- (c) **PROGRESS REPORTS:** UCT through its respective researchers shall furnish AFRINIC with written reports as to the progress of works carried out for the Project from time to time.

### **3.2 AFRINIC ’s Roles and Responsibilities**

- (a) Provide technical, logistical and financial support to the Project in coordination with relevant stakeholders.
- (b) Provide technical guidance on the overall architecture of the Project from a research, development and analysis perspective.

### 3.3 The Parties' Joint Responsibilities (*if any*)

- (a) Each Party agrees to collaborate on joint research publications, presentations and workshops in relation to ARDA.
- (b) Each Party shall respond promptly to any queries from the other Party from time to time in respect of the progress of the works in relation to the Project and any other matters in relation thereto by such means as are agreed from time to time by the Parties hereto.

## 4. RESEARCHERS

- 4.1 The researcher directing UCT's activities for the Project shall be **Dr. Josiah Chavula** (hereinafter referred to as "UCT Researcher") and the UCT Researcher may be assisted by other researcher(s) as appointed by UCT (hereinafter referred to as "UCT Co-Researcher"). In the event the UCT Researcher and/or the UCT Co-Researcher is unable to serve for the Project, UCT shall be entitled to nominate an alternate researcher to act as UCT Researcher and/or UCT Co-Researcher to carry out UCT's roles and responsibilities under this Agreement.
- 4.2 AFRINIC shall designate an AFRINIC researcher (hereinafter referred to as "AFRINIC Researcher") to carry out AFRINIC's roles and responsibilities under this Agreement.
- 4.3 The Parties agree that the UCT Researcher shall act as the Principal Researcher for the Project.

## 5. FUNDING

AFRINIC shall pay UCT in accordance with the approved Project budget in Schedule A. AFRINIC shall pay UCT a maximum of USD 94 148 for this Project. AFRINIC shall pay UCT a maximum of USD 40 171 for the duration of this Agreement, that is for Year 1. In the event that this Agreement is renewed for a further year, AFRINIC shall pay UCT a maximum of USD 33 232, that is for Year 2. In the event that this Agreement is renewed for a further year, AFRINIC shall pay UCT a maximum of USD 20 745, that is for Year 3. AFRINIC shall pay UCT annually in advance on execution of this Agreement and any subsequent renewals.

## 6. SCHOLARSHIPS

- 6.1 The Project shall include 1 PhD-student and 1 Masters student who may be appointed for this Project by the *UCT Researcher*, subject to the approved Project budget (Schedule A).

- 6.2 Students must be registered for research degrees at UCT in the Department of Computer Science and will be supervised by the *UCT Researcher*.
- 6.3 The PhD-student may be funded for a maximum of 3 years; renewed yearly subject to annual progress review.
- 6.4 The Masters student may be funded for a maximum of 2 years; renewal after the first year is subject to an annual progress review.
- 6.5 The students shall be selected by the *UCT Researcher* who shall pursuant to their selection send the students' details to AFRINIC for final approval. The necessary documents comprise a research topic and proposal, and the student's CV.
- 6.6 The Project will provide a scholarship funding of ZAR180,000 per annum per PhD- student, and ZAR160,000 per annum per Masters student. This amount will be disbursed to the students in quarterly lump sums by UCT.
- 6.7 Each recipient of a scholarship will receive a one-time grant of up to ZAR20,000 for laptop and software purchases.

## **6. INTELLECTUAL PROPERTY**

- 6.1 The Parties recognize and agree that all rights, titles and interests over the Background Intellectual Property of either Party and used to produce any product which forms the New Intellectual Property, are the separate property of the relevant Party and are not affected by this Agreement, and neither Party shall have any claims to or rights in the other Party's Background Intellectual Property.
- 6.2 Any New Intellectual Property resulting from the Project shall be promptly disclosed in writing to the other Party. The Parties shall hold such disclosure on a confidential basis and neither Party shall disclose the information to any third party without the written consent of the other Party.
- 6.3 All rights, titles and interests over the New Intellectual Property shall be jointly owned by UCT and AFRINIC.
- 6.4 Any Software developed in this Project will be released as Open-Source under the Apache 2.0 Licence. Publications emanating from this Project will be released under the Creative Commons 4.0 License.
- 6.5 The Parties shall retain the right to use the results of the Project for research, development and educational purposes.
- 6.6 In the event that the Parties intend to commercialize the New Intellectual Property, the Parties agree that a separate agreement shall be entered into between UCT and AFRINIC in relation to the commercialization.

- 6.7 Nothing contained in this Agreement shall be deemed to grant to either Party either directly or indirectly or by implication, estoppels or otherwise any license under any patents, patent applications or other proprietary interest over any Background Intellectual Property of either Party.

## **7. RIGHT TO PUBLISH**

The data and findings derived from the Project, which are of academic importance for the enrichment of knowledge, may be jointly or separately published by the Parties, provided that, where a Party intends to publish separately, it will furnish the other Party with a copy of the intended publication for review and feedback, at least 30 (thirty) days prior to publication.

## **8. TERMINATION**

- 8.1 UCT or AFRINIC (as the case may be) may terminate this Agreement by serving a notice to that effect. The notice to terminate shall not be less than thirty (30) days' written notice.
- 8.2 In the event of early termination of this Agreement by AFRINIC, AFRINIC shall pay all costs accrued by UCT as of the date of the notice of termination, including non-cancelable obligations, which shall include all awarded studentships and fellowships called for in Appendix A. In addition, AFRINIC will pay all other reasonable costs incurred by the UCT during the time period between the notification date and the termination date, which are necessary to terminate the Project. Reimbursement for incurred costs and obligations will not exceed the total estimated Project cost as shown in Schedule A attached hereto. Such termination shall not affect the completion of the students' studies.
- 8.3 Upon termination of this Agreement, both Parties shall have no obligation to each other save and except for payments still outstanding and payable by AFRINIC to UCT, for activities already undertaken prior to the date of such termination.

## **9. PUBLIC STATEMENT**

Both Parties agree that no public statement shall be made on the Project or in relation to any products, processes or inventions developed as a result of the Project unless approved first by both Parties.

## **10. NAME, OFFICIAL EMBLEM AND LOGO**

- 10.1 Neither Party shall use, nor permit any person or entity to use the name, acronym, official emblem, logo, trademark (or any variation thereof) or other Intellectual Property (hereinafter referred to as "Brand Materials") that is/are identified with or belongs to the

other Party on any publication, document, paper, audio or visual presentation, or for publicity purposes.

- 10.2 Any use of the Brand Materials for the purposes stated in clause 10.1 above shall first obtain the written consent of the other Party and shall comply with all conditions set by the other Party on the use of its Brand Materials.

## **11. DISPUTE SETTLEMENT AND GOVERNING LAW**

11.1 This Agreement shall be governed and construed in accordance with the laws of Mauritius.

11.2 In the event of a dispute arising out of or relating to this Agreement, the Parties shall first discuss the dispute and negotiate with each other with a view to reaching an amicable settlement.

11.3 If the dispute cannot be amicably settled through negotiation within 30 days, either Party may refer the dispute to arbitration and the decision of the Arbitrator will be final and binding.

11.4 Notwithstanding the foregoing, nothing hereinabove shall be construed as preventing either Party from seeking urgent injunctive relief from a competent court with jurisdiction to hear the matter.

## **12. NOTICES**

- 12.1 Any notice required to be given pursuant to this Agreement shall be in writing and shall be delivered by hand, ordinary mail or prepaid registered post to the addresses as set out hereinbelow or emailed to the Party concerned to the email address set out herein below:

UCT

Contractual/ Legal Notices:

The Director: Department of Research Contracts & Innovation, University of Cape Town, Allan Cormack House, 2 Rhodes Avenue, cnr Main Road, Mowbray, 7700, Cape Town, South Africa

[piet.barnard@uct.ac.za](mailto:piet.barnard@uct.ac.za)

All Other Notices (technical, scientific, reporting, financial etc.):

Dr Josiah Chavula

Room 317 Computer Science Building, 18 University Avenue, University of Cape Town, Rondebosch, 7700, Cape Town, South Africa

[Josiah.chavula@uct.ac.za](mailto:Josiah.chavula@uct.ac.za)



AFRINIC

Contractual/ Legal Notices:

Contact Person: Eddy Kayihura - Chief Executive Officer

Physical Address: 11<sup>th</sup> Floor, Standard Chartered Tower, Cybercity, Ebène,  
Mauritius

Email: [ceo@afritic.net](mailto:ceo@afritic.net)

All Other Notices (technical, etc.):

Contact Person: Cedrick Mbeyet - Stakeholder Development Manager

Physical Address: 11<sup>th</sup> Floor, Standard Chartered Tower, Cybercity, Ebène,  
Mauritius

Email: [cedrick.mbeyet@afritic.net](mailto:cedrick.mbeyet@afritic.net)

12.2 Any change of address of either Party shall be notified in writing to the other Party.

### **13. ENTIRE AGREEMENT**

The terms of the agreement between the Parties are those set out in this Agreement and the schedules hereto and this Agreement shall supersede all written or oral agreement or understanding made between the Parties prior to the date of this Agreement.

### **14. SUCCESSORS-IN-TITLE**

This Agreement shall be binding on the respective heirs, personal representatives, receivers, successors-in-title and permitted assigns of the Parties hereto.

### **15. AMENDMENT/MODIFICATION**

Any provision of this Agreement may be amended or modified by mutual consent between the Parties and such amendment/modification shall be in writing and signed by the duly authorized representative of the Parties.

### **16. NON-DISCRIMINATION**

UCT and AFRINIC agree not to discriminate against any person because of age, sex, national origin, race, ancestry, color, religious creed, disability or handicap, and sexual orientation.

**17. COUNTERPARTS**

This Agreement may be executed in any number of counterparts and each such counterpart shall constitute an original of this Agreement. This Agreement shall not be effective until each Party has executed at least one counterpart.

**18. HEADINGS SCHEDULES AND APPENDICES**

All schedules and appendices annexed hereto shall form part of this Agreement and shall be read, taken and construed as an essential part of this Agreement.

**19. COSTS**

The Parties shall bear their respective legal fees in respect of the preparation of this Agreement but the stamp duty on this Agreement shall be equally borne by the Parties.

**20. E-COMMUNICATION**

The Parties acknowledge and agree that electronic communication is an acceptable method of communicating information between the Parties without having to communicate the same on paper. Any communication and subsequent electronic signature that has been sent or signed in the past, present, or future between the Parties will hold the same force and effect as a document signed and inked on paper. **IN WITNESS WHEREOF** the Parties hereto have caused this Agreement to be signed on the day and year first above written.

SIGNED BY  
For and on behalf of

**University of Cape Town**

*Nadia Ebrahim*

Date Signed: 8 November 2021

Mrs Nadia Ebrahim  
.....  
**Title First Name Surname**  
Designation: Contracts Manager

SIGNED BY  
For and on behalf of

**African Network Information Centre  
(AfriNIC) Ltd**

*Kayihura N. Eddy*

**Mr Eddy Kayihura  
Chief Executive Officer**  
.....  
**Title First Name Surname**  
Designation

*AfriNIC Ltd  
Level 11ABC, Renaissance Tower  
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75100 FAX 4666756  
TEL: +262 21 251000  
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## SCHEDULE A

# African Route-collectors Data Analyzer (ARDA)

### Project Description

The proposed research project draws upon lessons from the African Route-collectors Data Analyzer (ARDA) [2] system and explores ways to improve the efficiency and effectiveness of inter-AS topology analysis and visualization. This project will critically evaluate the ARDA's efficiency in data handling, explore ways of improving the system's data pipeline, and investigate new and effective ways of visualizing the dataset. This will include evaluating the effectiveness of ARDA's data visualization and develop new ways of drawing usable insights from peering datasets. In particular, the project will study techniques for handling and presenting the datasets in time-series visualizations, and to provide better insights into the evolving nature of inter-AS topology. Another aspect of the study will involve developing techniques for effective visualization of the logical and geographical nature of inter-AS relationships. The aim of this project will be to find more effective ways of visualizing and drawing insights about traffic localization and new interconnection opportunities in the region, using detailed and up-to-date information from the peering ecosystem.

### Research Rationale and Motivation

Deployment decisions made by many of Africa's internet stakeholders have led to Internet operations that perform more poorly compared to their Western counterparts [1 - 6]. Furthermore, given that Internet performance is heavily influenced by global interconnections (e.g. Internet Exchange Points and Data Centers), which are mostly located in the Global North, networks in the developing countries do require additional mechanisms to achieve optimal exchange of Internet traffic. Potential solutions to Africa's interconnection problems are thus challenging and diverse. Yet, many of Africa's Internet challenges remain understudied. This deficiency makes it difficult to formulate evidence-based solutions, or evaluate the success of newly deployed technologies,

interconnections, and investment schemes.

The main aim of this research is to help improve the quality of Internet interconnection in Africa through the establishment of an internet measurement platform that collects, and analyses peering datasets and explores interconnection bottlenecks. Hence, the activities of this research are geared towards building bottom-up pan-African capacity for collecting, collating, visualising and evaluating interconnection data, such that specific technical and socioeconomic problems (i.e. Internet bottlenecks) can be identified and solved within individual networks and countries. This requires building a platform capable of longitudinal Internet data collection and analysis, and techniques for managing comprehensive and open datasets that accurately describe the status quo. The platform must also provide capabilities for network design - allowing stakeholders to visualize the topology and data sets, and to evaluate implications of new or potential interconnections, policies and technical solutions. Importantly, emphasis must be placed on *communicating and visualising data*, such that stakeholders can better understand the state of interconnectivity in Africa and understand the potential benefits of new infrastructure deployments.

## Research Questions

The key questions to be investigated in this research are, firstly, how best to orchestrate collection of interconnection dataset. This question is important in ensuring efficient network and computer resource utilization, and to increase completeness of data collection. The second question focuses on how Internet measurement data can be used to improve interconnectivity in Africa. In this regard, we explore mechanisms for near-real-time analysis to orchestrate and improve visualization of Internet measurements data, to support network design, and to inform the discourse on interconnection policy formulation. Specific research activities to support these research questions are as follows:

### 1) Efficient Route Data Management

To synthesize Africa-oriented BGP data from several collectors and make it more real-time accessible. This research component will explore alternative techniques for data pipelining, scheduling and synchronization of network measurement data. This will also include evaluating strategies for data replication and caching at multiple locations. Ultimately, this research will perform empirical analyses of alternative techniques for management of interconnection data and will propose optimal measurement scheduling algorithms.

## 2) Visualizing and Simulating Africa’s Internet Topology

This research component will explore visualisation strategies for Africa’s Internet topology and metrics and implement a simulation platform for internet interconnection and performance. This research will include designing and evaluating appropriate interfaces and underlying toolkits that could allow stakeholders to interact with the interconnection data. The front-end platform will include an underlying simulator specifically for the African internet topology that will enable experimentation with different internetwork and interconnection strategies.

We will disseminate our results through regional industry conferences on Internet development, such as the Africa Peering Forum (AfPIF), the Africa Internet Summit (AIS), and Africa’s Internet Governance Forum (IGF), as well as other public media and engagements with key national regulators and policy makers. We will also produce academic publications at regional and international conferences and journals, including IEEE/ACM Transactions on Networking, ACM IMC, IEEE INFOCOM, Information Systems Research, ITID, and Telecommunications Policy.

### Budget and Resources:

**Principal Investigator:** Dr Josiah Chavula, University of Cape Town

	Total (USD)	Year1	Year2	Year3
STAFF COSTS	5 220	1 624	1 737	1 859
Bursaries & Scholarships	61 308	25 886	23 161	12 262
Research Assistants	10 218	3 406	3 406	3 406
Equipment	4 087	4 087	0	0
Conference	6 131	2 044	2 725	1 362
<b>TOTAL DIRECT COST</b>	<b>86 964</b>	<b>37 046</b>	<b>31 029</b>	<b>18 889</b>
Indirect Cost	7 184	3 125	2 203	1 856
<b>FULL COST + MARK UP</b>	<b>94 148</b>	<b>40 171</b>	<b>33 232</b>	<b>20 745</b>

## References

- [1] Formoso, A., Chavula, J., Phokeer, A., Sathiaseelan, A. and Tyson, G., 2018, April. Deep diving into Africa's inter-country latencies. In *IEEE INFOCOM 2018-IEEE Conference on Computer Communications* (pp. 2231-2239). IEEE.
- [2] Fanou, R., Sanchez-Agüero, V., Valera, F., Mwangi, M., & Coffin, J. (2019). A system for profiling the IXPs in a region and monitoring their growth: Spotlight at the internet frontier. *International Journal of Network Management*, 29(2), e2056.
- [3] M. Chetty, S. Sundaresan, S. Muckaden, N. Feamster and E. Calandro, "Measuring broadband performance in South Africa," in *Proceedings of the 4th Annual Symposium on Computing for Development*, 2014.
- [4] A. Gupta, M. Calder, N. Feamster, M. Chetty, E. Calandro and E. Katz-Bassett, "Peering at the internet's frontier: A first look at isp interconnectivity in africa," in *International Conference on Passive and Active Network Measurement*, 2014.
- [5] R. Fanou, P. Francois, E. Aben, M. Mwangi, N. Goburdhan and F. Valera, "Four Years Tracking Unrevealed Topological Changes in the African Interdomain," *Computer Communications*, 2017.
- [6] Y. Zaki, J. Chen, T. Pötsch, T. Ahmad and L. Subramanian, "Dissecting Web Latency in Ghana," in *ACM Internet Measurement Conference*, 2014.
- [7] I. Castro, J. C. Cardona, S. Gorinsky and P. Francois, "Remote Peering: More Peering Without Internet Flattening," in *International on Conference on emerging Networking Experiments and Technologies*, 2014.