Failure Prediction And Detection In Cloud Datacenters

Purvil Bambharolia, Prajeet Bhavsar, Vivek Prasad

Abstract: Cloud computing is a novel technology in the field of distributed computing. Usage of Cloud computing is increasing rapidly day by day. In order to serve the customers and businesses satisfactorily, fault occurring in datacenters and servers must be detected and predicted efficiently in order to launch mechanisms to tolerate the failures occured. Failure in one of the hosted datacenters may propagate to other datacenters and make the situation worse. In order to prevent such situations, one can predict a failure proliferating throughout the cloud computing system and launch mechanisms to deal with it proactively. One of the ways to predict failures is to train a machine to predict failure on the basis of messages or logs passed between various components of the cloud. In the training session, the machine can identify certain message patterns relating to failure of data centers. Later on, the machine can be used to check whether a certain group of message logs follow such patterns or not. Moreover, each cloud server can be defined by a state which indicates whether the cloud is running properly or is facing some failure. Parameters such as CPU usage, memory usage etc. can be maintained for each of the servers. Using this parameters, we can add a layer of detection where in we develop a decision tree based on these parameters which can classify whether the passed in parameters to the decision tree indicate failure state or proper state.

Index Terms: Cloud computing; failure prediction; failure detection; cloud datacenters; probability and statistics; Bayesian probability; machine learning

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1 INTRODUCTION

Cloud computing is one of the new buzzwords in the world of computer science and engineering. One of the main features that cloud service providers offers its customers is the ability to pay per use. Cloud computing also incorporates self-service and thus aiming at Autonomic computing. It also aims at providing businesses with a scalable and adaptive environment. Businesses are provided with various deployment models to choose from. Some of the deployment models include public cloud. Public cloud hosts all the data and resources on public servers which can be accessed by everyone. Private cloud is another type of model where the data is hosted on datacenters located on premise locations. Community cloud is another type of model where a set of organizations or businesses share a cloud datacenter. Hybrid model is a solution to insufficient capacity of the private cloud. Organizations are provided with an ability to subscribe to public cloud services when facing insufficient resources. This is termed as "cloud bursting" [1]. According to [1], cloud provides myriad of advantages which the local data centers cannot. These includes scalability, data security, fault tolerance, pay per use, dynamic resource allocation and much more. As a result, many giant organizations and local businesses are opting to migrate the local data in datacenters onto the cloud. It provides a level of abstraction and thus obviates the need for the users to manage the complex hardware and infrastructure. Being said that, there are many Quality of Service (QoS) parameters which the cloud service providers (CSPs) need to provide as per the Service Level Agreements (SLAs) with their customers. One important parameter is availability of resources [2].

2 LITERATURE SURVEY

Author Name	Paper Name	Year Published	Problems	Open Research Issues
Yukihiro Wantabe, Hiroshi Otsuka, Masataka Soneda, Shinji Kikuchi and Yasuhide Matsumoto	Online Failure Prediction in Cloud Datacenters by Real-Time Message Pattern Learning	2012	Various types of message logs communicated between components	In the future, accuracy can be improved by including more parameters.
Qijang Guan, Ziming Zhang and Song Fu	Ensemble of Bayesian Predictors and Decision Trees for Proactive Failure Management in Cloud Computing Systems	2012	Assumption that training dataset is labeled;	In future, integrating two failure management approaches will lead to better dependability
Husanbir Pannu, Jianguo Liu, Qiang Guan and Song Fu	AFD: Adaptive Failure Detection System for Cloud Computing Infrastructures	2012	The runtime performance data is usually unlabeled and thus a prior failure history is not always available.	Integrating the proactive and reactive failure management approaches like check pointing and redundant execution can increase the fault detection accuracy.

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Failure Prediction And Detection In Cloud Datacenters:

   Cloud Reliability Engineering Rathnakar Achary,Pethuru Raj,2021-04-11 Coud reliability engineering is a leading issue of cloud services Cloud service providers guarantee computation storage and applications through service level agreements SLAs for promised levels of performance and uptime Cloud Reliability Engineering Technologies and Tools presents case studies examining cloud services their challenges and the reliability mechanisms used by cloud service providers These case studies provide readers with techniques to harness cloud reliability and availability requirements in their own endeavors Both conceptual and applied the book explains reliability theory and the best practices used by cloud service companies to provide high availability It also examines load balancing and cloud security Written by researchers and practitioners the book s chapters are a comprehensive study of cloud reliability and availability issues and solutions Various reliability class distributions and their effects on cloud reliability are discussed An important aspect of reliability block diagrams is used to categorize poor reliability of cloud infrastructures where enhancement can be made to lower the failure rate of the system This technique can be used in design and functional stages to determine poor reliability of a system and provide target improvements Load balancing for reliability is examined as a migrating process or performed by using virtual machines The approach employed to identify the lightly loaded destination node to which the processes virtual machines migrate can be optimized by employing a genetic algorithm To analyze security risk and reliability a novel technique for minimizing the number of keys and the security system is presented The book also provides an overview of testing methods for the cloud and a case study discusses testing reliability installability and security A comprehensive volume Cloud Reliability Engineering Technologies and Tools combines research theory and best practices used to engineer reliable cloud availability and performance   *Proceedings of the Fourth International Conference on Advances in Computer Engineering and Communication Systems (ICACECS 2023)* C. Kiran Mai,D. N. Vasundhara,P. V. Siva Kumar,K. Srujan Raju,Raghava Rao Mukkamala,S. Nagini,A. Brahmananda Reddy,G. S. Ramesh,V. Baby,P. Venkateswara Rao,2023-12-21 This is an open access book The Department of Computer Science Engineering VNR VJIET successfully organized a 2 Day International e Conference International Conference on Advances in Computer Engineering and Communication Systems ICACECS ICACECS 2020 ICACECS 2021 and ICACECS 2022 consecutively for 3 years This conference is conducted in association with Atlantis Highlights in Computer Science AHCS Atlantis Press part of Springer Nature the publication partner and technically sponsored by Computer Society of India CSI Every year there was an overwhelming response from researchers around the globe publishing their research contributions in Smart Innovations in Mezzanine Technologies Data Analytics Networks and Communication Systems the theme of the conference Continuing this legacy the international e conference ICACECS 2023 is now scheduled to be conducted on 22nd 23rd September 2023 This year ICACECS 2023 is also co located at THE UNIVERSITY OF THE WEST INDIES UWI AT MONA JAMAICA UWI Mona Jamaica is the founding campus of the unique multi

part multi national University of the West Indies The square mile site welcomed its first undergraduates 33 medical students from across the West Indies or now more often the Caribbean in October 1948 The UWI is the region s premier educational institution with faculties offering a wide range of undergraduate masters and doctoral programmes in Humanities and Education Science and Technology Science and Agriculture Engineering Law Medical Sciences and Social Sciences Authors are solicited to contribute their submissions illustrating research results and innovations and significant advances in the fields of Artificial Intelligence Machine learning Smart Systems Networks and Communication Systems Quantum computing Knowledge Engineering and Ontology Internet of Things Education Technology and Business Engineering ICACECS 2023 is a unique forum bringing together scholars from the different countries to participate and transform the Research Landscape of the globe and carve a Road Map for Implementation It provides a valuable networking opportunity and brings a new era for the Research scholars Students Professors Industrialists providing insights to the recent trends and developments in the field of Computer Science with a special focus on Mezzanine technologies   Intelligent Systems and Machine Learning Sachi Nandan Mohanty,Vicente Garcia Diaz,G. A. E. Satish Kumar,2023-07-09 This two volume set constitutes the refereed proceedings of the First EAI International Conference on Intelligent Systems and Machine Learning ICISML 2022 held in Hyderabad India in December 16 17 2022 The 75 full papers presented were carefully reviewed and selected from 209 submissions The conference focuses on Intelligent Systems and Machine Learning Applications in Health care Digital Forensic Intelligent Communication Wireless Networks Internet of Things IoT Applications Social Informatics and Emerging Applications   Green, Pervasive, and Cloud Computing Zhiwen Yu,Christian Becker,Guoliang Xing,2020-12-04 This book constitutes the refereed proceedings of the 15th International Conference on Green Pervasive and Cloud Computing GPC 2020 held in Xi an China in November 2020 The 30 full papers presented in this book together with 8 short papers were carefully reviewed and selected from 96 submissions They cover the following topics Device free Sensing Machine Learning Recommendation Systems Urban Computing Human Computer Interaction Internet of Things and Edge Computing Positioning Applications of Computer Vision CrowdSensing and Cloud and Related Technologies   Computational Science and Its Applications – ICCSA 2021 Osvaldo Gervasi,Beniamino Murgante,Sanjay Misra,Chiara Garau,Ivan Blečić,David Taniar,Bernady O. Apduhan,Ana Maria A. C. Rocha,Eufemia Tarantino,Carmelo Maria Torre,2021-09-09 The ten volume set LNCS 12949 12958 constitutes the proceedings of the 21st International Conference on Computational Science and Its Applications ICCSA 2021 which was held in Cagliari Italy during September 13 16 2021 The event was organized in a hybrid mode due to the Covid 19 pandemic The 466 full and 18 short papers presented in these proceedings were carefully reviewed and selected from 1588 submissions The books cover such topics as multicore architectures blockchain mobile and wireless security sensor networks open source software collaborative and social computing systems and tools cryptography applied mathematics human computer interaction software design engineering and others Part IX of the set includes the proceedings

of the following events 13th International Symposium on Software Engineering Processes and Applications SEPA 2021 International Workshop on Sustainability Performance Assessment models approaches and applications toward interdisciplinary and integrated solutions SPA 2021 *Large-Scale Disk Failure Prediction* Cheng He,Mengling Feng,Patrick P. C. Lee,Pinghui Wang,Shujie Han,Yi Liu,2020-08-05 This book constitutes the thoroughly refereed post competition proceedings of the AI Ops Competition on Large Scale Disk Failure Prediction conducted between February 7th and May 15 2020 on the Alibaba Cloud Tianchi Platform A dedicated workshop featuring the best performing teams of the competition was held at the 24th Pacific Asia Conference on Knowledge Discovery and Data Mining PAKDD 2020 in Singapore in April 2019 Due to the COVID 19 pandemic the workshop was hosted online This book includes 13 selected contributions an introduction to dataset selected approaches of the competing teams and the competition summary describing the competition task practical challenges evaluation metrics etc [Proceeding of the International Conference on Computer Networks, Big Data and IoT (ICCBI - 2019)](#) A. Pasumpon Pandian,Ram Palanisamy,Klimis Ntalianis,2020-03-04 This book presents the proceedings of the International Conference on Computing Networks Big Data and IoT ICCBI 2019 held on December 19 20 2019 at the Vaigai College of Engineering Madurai India Recent years have witnessed the intertwining development of the Internet of Things and big data which are increasingly deployed in computer network architecture As society becomes smarter it is critical to replace the traditional technologies with modern ICT architectures In this context the Internet of Things connects smart objects through the Internet and as a result generates big data This has led to new computing facilities being developed to derive intelligent decisions in the big data environment The book covers a variety of topics including information management mobile computing and applications emerging IoT applications distributed communication networks cloud computing and healthcare big data It also discusses security and privacy issues network intrusion detection cryptography 5G 6G networks social network analysis artificial intelligence human machine interaction smart home and smart city applications **Advanced Data Mining and Applications** Shuigeng Zhou,Songmao Zhang,George Karypis,2012-12-09 This book constitutes the refereed proceedings of the 8th International Conference on Advanced Data Mining and Applications ADMA 2012 held in Nanjing China in December 2012 The 32 regular papers and 32 short papers presented in this volume were carefully reviewed and selected from 168 submissions They are organized in topical sections named social media mining clustering machine learning algorithms and applications classification prediction regression and recognition optimization and approximation mining time series and streaming data Web mining and semantic analysis data mining applications search and retrieval information recommendation and hiding outlier detection topic modeling and data cube computing **Artificial Intelligence and Soft Computing** Leszek Rutkowski,Marcin Korytkowski,Rafal Scherer,Ryszard Tadeusiewicz,Lotfi A. Zadeh,Jacek M. Zurada,2015-06-04 The two volume set LNAI 9119 and LNAI 9120 constitutes the refereed proceedings of the 14th International Conference on Artificial Intelligence and Soft Computing

ICAISC 2015 held in Zakopane Poland in June 2015 The 142 revised full papers presented in the volumes were carefully reviewed and selected from 322 submissions These proceedings present both traditional artificial intelligence methods and soft computing techniques The goal is to bring together scientists representing both areas of research The first volume covers topics as follows neural networks and their applications fuzzy systems and their applications evolutionary algorithms and their applications classification and estimation computer vision image and speech analysis and the workshop large scale visual recognition and machine learning The second volume has the focus on the following subjects data mining bioinformatics biometrics and medical applications concurrent and parallel processing agent systems robotics and control artificial intelligence in modeling and simulation and various problems of artificial intelligence Energy Efficiency in Data Centers and Clouds ,2016-01-28 Advances in Computers carries on a tradition of excellence presenting detailed coverage of innovations in computer hardware software theory design and applications The book provides contributors with a medium in which they can explore their subjects in greater depth and breadth than journal articles typically allow The articles included in this book will become standard references with lasting value in this rapidly expanding field Presents detailed coverage of recent innovations in computer hardware software theory design and applications Includes in depth surveys and tutorials on new computer technology pertaining to computing combinatorial testing constraint based testing and black box testing Written by well known authors and researchers in the field Includes extensive bibliographies with most chapters Presents volumes devoted to single themes or subfields of computer science **Cloud Computing and Services Science** Donald Ferguson,Claus Pahl,Markus Helfert,2021-03-22 This book constitutes extended revised and selected papers from the 10th International Conference on Cloud Computing and Services Science CLOSER 2020 held in Prague Czech Republic in May 2020 Due to the COVID 19 pandemic the conference was held in a virtual format The 14 papers presented in this volume were carefully reviewed and selected from a total of 69 submissions CLOSER 2020 focuses on the emerging area of cloud computing inspired by some latest advances that concern the infrastructure operations and available servicesthrough the global network **Database Systems for Advanced Applications. DASFAA 2023 International Workshops** Amr El Abbadi,Gillian Dobbie,Zhiyong Feng,Lu Chen,Xiaohui Tao,Yingxia Shao,Hongzhi Yin,2023-09-27 This volume constitutes the papers of several workshops which were held in conjunction with the 28th International Conference on Database Systems for Advanced Applications DASFAA 2023 held in Tanjin China in April 2023 The 23 revised full papers presented in this book were carefully reviewed and selected from 40 submissions DASFAA 2023 presents the following four workshops 9th International Workshop on Big Data Management and Service BDMS 2023 8th International Workshop on Big Data Quality Management BDQM 2023 7th International Workshop on Graph Data Management and Analysis GDMA 2023 1st International Workshop on Bundle based Recommendation Systems BundleRS 2023 *Quantum Computing Models for Cybersecurity and Wireless Communications* Budati Anil Kumar,Singamaneni Kranthi Kumar,Li Xingwang,2025-03-18 The

book explores the latest quantum computing research focusing on problems and challenges in the areas of data transmission technology computer algorithms artificial intelligence based devices computer technology and their solutions Future quantum machines will exponentially boost computing power creating new opportunities for improving cybersecurity Both classical and quantum based cyberattacks can be proactively identified and stopped by quantum based cybersecurity before they harm Complex math based problems that support several encryption standards could be quickly solved by using quantum machine learning This comprehensive book examines how quantum machine learning and quantum computing are reshaping cybersecurity addressing emerging challenges It includes in depth illustrations of real world scenarios and actionable strategies for integrating quantum based solutions into existing cybersecurity frameworks A range of topics are examined including quantum secure encryption techniques quantum key distribution and the impact of quantum computing algorithms Additionally it talks about machine learning models and how to use machine learning to solve problems Through its in depth analysis and innovative ideas each chapter provides a compilation of research on cutting edge quantum computer techniques like blockchain quantum machine learning and cybersecurity Audience This book serves as a ready reference for researchers and professionals working in the area of quantum computing models in communications machine learning techniques IoT enabled technologies and various application industries such as finance healthcare transportation and utilities

Hardware Accelerators in Data Centers Christoforos Kachris,Babak Falsafi,Dimitrios Soudris,2018-08-21 This book provides readers with an overview of the architectures programming frameworks and hardware accelerators for typical cloud computing applications in data centers The authors present the most recent and promising solutions using hardware accelerators to provide high throughput reduced latency and higher energy efficiency compared to current servers based on commodity processors Readers will benefit from state of the art information regarding application requirements in contemporary data centers computational complexity of typical tasks in cloud computing and a programming framework for the efficient utilization of the hardware accelerators **Data Analytics and Management** Ashish Khanna,Deepak Gupta,Zdzisław Pólkowski,Siddhartha Bhattacharyya,Oscar Castillo,2021-01-04 This book includes original unpublished contributions presented at the International Conference on Data Analytics and Management ICDAM 2020 held at Jan Wyzykowski University Poland during June 2020 The book covers the topics in data analytics data management big data computational intelligence and communication networks The book presents innovative work by leading academics researchers and experts from industry which is useful for young researchers and students *Service-Oriented Computing – ICSOC 2020 Workshops* Hakim Hacid,Fatma Outay,Hye-young Paik,Amira Alloum,Marinella Petrocchi,Mohamed Reda Bouadjenek,Amin Beheshti,Xumin Liu,Abderrahmane Maaradji,2021-05-29 This book constitutes revised and selected papers from the scientific satellite events held in conjunction with the18th International Conference on Service Oriented Computing ICSOC 2020 The conference was held virtually during December 14 17 2020 A total of 125 submissions were received for the

satellite events The volume includes 9 papers from the PhD Symposium Track 4 papers from the Demonstration Track and 45 papers from the following workshops International Workshop on Artificial Intelligence for IT Operations AIOps International Workshop on Cyber Forensics and Threat Investigations Challenges in Emerging Infrastructures CFTIC 2020 2nd Workshop on Smart Data Integration and Processing STRAPS 2020 International Workshop on AI enabled Process Automation AI PA 2020 International Workshop on Artificial Intelligence in the IoT Security Services AI IOTS 2020 Cooperative Information Systems Marco Comuzzi,Daniela Grigori,Mohamed Sellami,Zhangbing Zhou,2025-02-13 This book constitutes the refereed proceedings of the 30th International Conference on Cooperative Information Systems CoopIS 2024 held in Porto Portugal during November 19 21 2024 The 16 full papers 11 short papers and 2 invited papers were carefully reviewed and selected from 78 submissions They were organized in topical sections as follows processes and human in the loop process analytics and technology process improvement knowledge graphs and knowledge engineering predictive process monitoring services and cloud and short papers **Big-Data-Analytics in Astronomy, Science, and Engineering** Shelly Sachdeva,Yutaka Watanobe,Subhash Bhalla,2022-02-17 This book constitutes the proceedings of the 9th International Conference on Big Data Analytics BDA 2021 which took place virtually during December 7 9 2021 The 15 full papers and 1 short paper included in this volume were carefully reviewed and selected from 60 submissions They were organized in topical sections as follows Data science systems data science architectures big data analytics in healthcare support systems information interchange of web data resources and business analytics Security in Computing and Communications Sabu M. Thampi,Guojun Wang,Danda B. Rawat,Ryan Ko,Chun-I Fan,2021-02-09 This book constitutes revised selected papers of the 8th International Symposium on Security in Computing and Communications SSCC 2020 held in Chennai India in October 2020 Due to the COVID 19 pandemic the conference was held online The 13 revised full papers and 8 revised short papers presented were carefully reviewed and selected from 42 submissions The papers cover wide research fields including cryptography database and storage security human and societal aspects of security and privacy **Smart Computing and Communication** Meikang Qiu,Keke Gai,Han Qiu,2022-03-14 This book constitutes the proceedings of the 6th International Conference on Smart Computing and Communication SmartCom 2021 which took place in New York City USA during December 29 31 2021 The 44 papers included in this book were carefully reviewed and selected from 165 submissions The scope of SmartCom 2021 was broad from smart data to smart communications from smart cloud computing to smart security The conference gathered all high quality research industrial papers related to smart computing and communications and aimed at proposing a reference guideline for further research Conference was held online due to the COVID 19 pandemic

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