International Journals of Advanced Research in Computer Science and Software Engineering
ISSN: 2277-128X (Volume-9, Issue-3)

Research Article | **March 2019**

Proactive Computing

Matthew N. O. Sadiku, Mahamadou Tembely, and Sarhan M. Musa
Roy G. Perry College of Engineering, Prairie View A&M University, Prairie View, TX 77446, United States
Email: sadiku@ieee.org; matembely@pvamu.edu; smmusa @pvamu.edu

Abstract— Proactive computing refers to the use of systems to predict future events and react to these predictions before the events occur. It describes a departure from interactive or classical computing which reacts to changes in the context. Proactive system releases the users from having to interact with systems and it would adjust to users' actions and movements without their control. It promises to propel society beyond interactive computing. This paper provides a brief introduction to proactive computing.

Keywords— proactive computing, proactive event-driven computing, proactive systems

I. INTRODUCTION

Networked computers proactively anticipate our needs and take actions on our behalf to meet those needs. When computers get to know the wants and needs of the user and acts accordingly, it will greatly increase productivity.

Proactivity refers to the ability to eliminate undesired future events by applying prediction and automated decision-making technologies. It is initiating change. Proactive behavior by individuals refers to self-initiated behavior in situations. Proactive behavior involves taking control and acting in advance of a future situation, rather than just reacting or waiting for something to happen. A proactive person takes responsibility for his or her life [1]. Proactive applications in the IT infrastructure include proactive security systems, proactive routing in mobile ad-hoc wireless networks, proactive network management with failure handling, proactive response to a denial of service attack, proactive elimination of gridlock in mining roads, and proactive event-driven computing [2].

The term "proactive computing" was introduced by David Tennenhouse in his paper [3]. Proactive computing (or proactive event-driven computing) evolves from reactive computing. While reactive or standard computing defines the behavior as automatic reaction to events as they occur, in proactive computing reacts to events that are expected or predicted to occur in the future [4]. Proactive computing is closely related to ubiquitous computing and autonomous computing. Both autonomic and proactive address the issues that limit the growth of today's computing systems. Autonomic computing addresses the problem of managing complexity.

II. PROACTIVE SYSTEMS

Proactive systems are unobtrusive systems that connect to the physical world and require little or no help from human. They anticipate the user's needs and act on their own initiative. The control elements of proactive systems will be interconnected through networking. A proactive system is usually faster than human. Proactive systems adhere to two premises: working on behalf of the user and acting on their own initiative without a user's explicit command. This is a major departure from interactive computing systems.

Seven principles describe the foundations of proactive systems: connecting with the physical world, deep networking, macro-processing, dealing with uncertainty, anticipation, closing the control loop, and making systems personal [5]. Proactive systems use sensors and actuators to both monitor and shape their physical environment. We provide three examples of proactive systems.

First, the proactive sensor network uses sensors and actuators to make distributed decisions. The network is proactive because the sensors themselves preprocess their sensed data [5]. Second, the system automatically adjusts the lighting of a room based on what it anticipates the users desire is. Third, proactive mobile computing tools will allow patients to maintain control of their condition by monitoring their metabolic performance. The tools are designed to empower people with chronic condition [6].

III. CHALLENGES

Several ethical issues that have been brought forward in the context of proactive computing. Since proactive systems can act autonomously and designers cannot fully control their learning systems, the issue of responsibility needs to be addressed in practice. The problem is deciding where the responsibility for wrong decisions lies [7].

The embedding of proactive technology into highly sensitive environments, such as the home, produces specific design challenges that are linked to ethical issues. Proactive solutions have to be both personalized and consistent [8].

IV. CONCLUSIONS

Current interactive computing systems are fundamentally limited. They are only reactive and wait for an instruction from the user. Proactive computing systems aim at acting on behalf of the user. The majority of new computers will be proactive. Pervasive systems are becoming popular with the penetration of mobile devices. There is a growing trend in all fields to allow computing systems to influence decision making.

Proactive technologies can live up to that expectation if properly implemented.

REFERENCES

[1] [1] "Proactivity," Wikipedia, the free encyclopedia https://en.wikipedia.org/wiki/Proactivity

[2] Y. Engel and O. Etzion, "Towards proactive event-driven computing," *Proceedings of the 5th ACM international Conference on Distributed Event-based System*, July 2011, pp. 125-136.

[3] D.L. Tennenhouse, "Proactive computing," *Communications of the ACM*, vol. 43, no. 5, May 2000, pp. 43–50.

[4] Y. Engel, O. Etzion, and Z. Feldman. "A basic model for proactive event-driven computing," *Proceedings of the 6th ACM International Conference on Distributed Event-Based Systems*, July 2012, pp. 107-118.

[5] S. VanSyckel and C. Becker, "A survey of proactive pervasive computing," *Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, Seattle, September 2014, pp. 421-430.

[6] A. G. Mathews and R. Butler, "A vision for the use of proactive mobile computing tools to empower people with chronic conditions," Proceedings *of the 18th IEEE Symposium on Computer-Based Medical Systems*, 2005.

[7] S.L. Venter, M.S. Olivier, and J. J. Britz, "Toward a model of responsibility for proactive systems," *Journal of Information Ethics*, vol. 17, no. 2, Spring 2008, pp. 78–90.

[8] F. Mäyrä and T. Vadén, "Ethics of living technology design principles for proactive home environments," *Human IT*, vol. 7, no. 2, 2004, pp. 171–196.

ABOUT THE AUTHORS

Matthew N.O. Sadiku (sadiku@ieee.org) is a professor at Prairie View A&M University, Texas. He is the author of several books and papers. He is a fellow of IEEE.

Mahamadou Tembely (mtembely@student.pvamu.edu) received his doctoral degree from Prairie View A&M University, Texas. He received the 2014 Outstanding MS Graduated Student award for the department of electrical and computer engineering. He is the author of several papers.

Sarhan M. Musa (smmusa@pvamu.edu) is an associate professor in the Department of Engineering Technology at Prairie View A&M University, Texas. He has been the director of Prairie View Networking Academy, Texas, since 2004. He is an LTD Sprint and Boeing Welliver Fellow

