AI and Autonomic Computing in 2026

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***Abstract*— With Autonomic Computing now in its 25th year, this paper summarizes a special track "AI and Autonomic Computing in 2026". To assist in meeting the AC Vision, this session addresses the continuing research that deals with the general question 'can Autonomic Computing benefit from or be a significant part of the latest A.I. incarnation – Generative AI, as it moves towards Artificial General Intelligence (AGI)?'**

Keywords; *Artificial Intelligence; A.I.; Autonomic Computing; Autonomic Systems; Generative A.I.; Artificial General Intelligence, Agentic AI.*

I. INTRODUCTION

Last year's AIAC [1] presented that Gartner's Hype Cycle for **Emerging Tech 2022**, and Gartner's Hype Cycle for **Artificial Intelligence 2023, both** had Autonomic Systems (re-)appearing 20+ years after Autonomic Computing was launch by IBM, as a call to industry and academia, in 2001 [2].

Autonomic Systems was still present in the **2024 AI Hype Cycle** (Figure 1) but by 2025, Autonomic Systems has vanished (Figure 2) despite the previous classification of 5-10 year to reach plateau! So what has happened in the mean time? If we reconsider how Gartner recently described Autonomic Systems;

"***Autonomic systems*** *are examples of accelerated AI automation. They are self-managing physical or software systems, performing domain-bounded tasks that exhibit three fundamental characteristics:* ***autonomy, learning and agency.*** *When traditional AI techniques aren't able to achieve business adaptability, flexibility and agility, autonomic systems can be successful in helping with implementation. Autonomic systems will take five to ten years until mainstream adoption but will be transformational to organizations.*" [3].

"... Innovation Trigger, so for example on this year's Hype Cycle we have ***Autonomic Systems*** *which is more around actual evolution of AI into systems which can take actions and decide or plans the tasks to accomplish, and to achieve, and can achieve some of those things in an autonomous kind of way as well,* ***and then we also have multi-agents systems, which are kind of related to Autonomic Systems as well, where we have different AI agents collaborating together in order to achieve a particular outcome.*** *..."* [4] *(podcast 15mins 08secs in).*

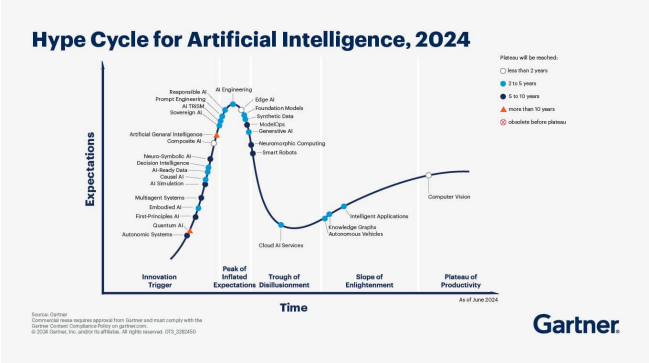

Figure 1 Gartner's Hype Cycle for A.I 2024 has Autonomic Systems on the curve (5-10 years to reach plateau)

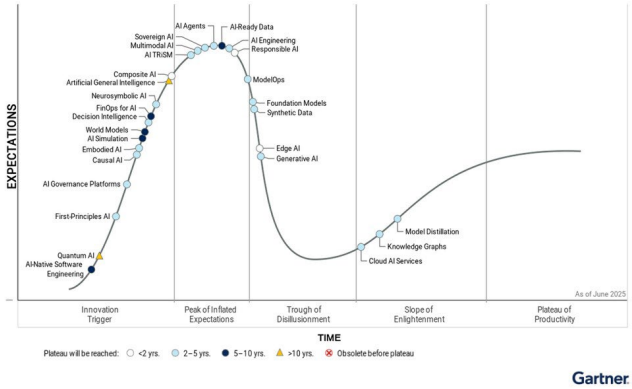

Figure 2 Gartner's Hype Cycle for A.I 2025 - Autonomic Systems no longer on the curve

Agency is described as a main characteristic of **Autonomic Systems (AS)**. So has **Agentic AI** become a better way to describe the AS aims given the new Gen-AI environment? Note AI Agents is in the 2025 hype cycle, Agentic AI isn't, but one would be surprised if it does not appear in 2026, and perhaps Agentic AI is replacing the term Autonomic Systems from this Gartner perspective.

So does this Agency / Agentic AI view of Autonomic Systems fit with the original Autonomic Computing (AC)

vision from IBM, first proposed in 2001 [6], and researched over the next quarter of a century? That is a much larger discussion than can be presented here (although the fourth paper in the session makes a start), but interestingly when presenting that question recently, "is Agentic AI replacing Autonomic Systems as our research field?" [7] one of my PhD researchers responded, "no, Agentic AI is just the latest that helps us enroute to achieve the vision of Autonomic Computing"!

Be it under the label Autonomic Systems/Computing or Agentic AI (be it for funding or publishing or impact motivations), the vision and aim of such research, and specifically AI+AC, is still to reach that vision – to create self-managing computing systems that can operate with minimal human intervention in a trustworthy fashion.

II. SUBMISSIONS

The first paper is "Extending MAPE-K with Data Augmentation to mitigate Data Scarcity", where MAPE-K is the Autonomic Computing Monitor-Analyze-Plan-Execute with Knowledge Loop, by Saunders et.al. [9], following on from [8]. The deployment of autonomous swarms in remote or hazardous environments, such as space exploration, presents significant challenges for data collection. The vast distance from Earth requires fully autonomous and autonomic operation, without human intervention. Autonomic Computing, through the MAPE-K loop, provides a structured framework for self-management. Such systems rely on the processing of both internal and external data to inform decision-making. When data are scarce or incomplete, system reliability is consequently reduced.

This paper [9] addresses the problem of data scarcity by presenting and evaluating the effectiveness of numerical interpolation techniques to reconstruct missing data generated by a multi-robot swarm. The interpolated values are used to complete an existing dataset, which is subsequently processed through a data generation and evaluation pipeline. The results demonstrate that interpolation combined with data generation can produce high-quality synthetic data, offering a viable approach to mitigating data scarcity.

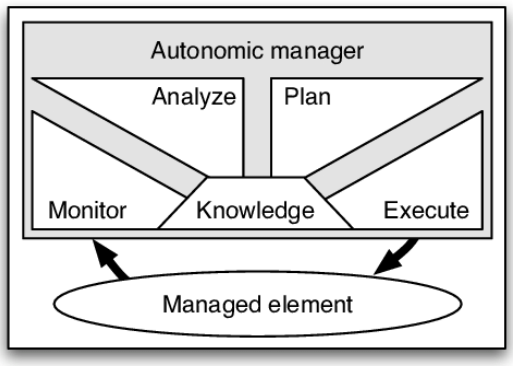

Figure 3 IBM's Autonomic Element - "MAPE-K" Control Loop [6]

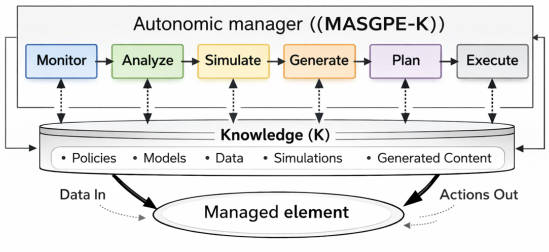

Figure 4 Extending MAPE-K to MASGPE-K

The significance of this approach is the potential of adding Simulation and Generation into the MAPE-K (Figure 3) -> MASGPE-K (Figure 4), as well as providing opportunities for synthetic data generation within the Autonomic Element/Manager when there is a scarcity of data due to it being, for instance, at the start of a mission/sub-mission, or broken or intermittent errors from sensors.

The second paper, "A Reproducible Framework for Evaluating Autonomic Swarm Recruitment" by Parvathy Preeya Santhosh Kumar et al., [10], is "Enhancing MegaSwarm with Systematic Metrics, Visualization, and Performance Analysis". Swarm robotics provides scalability in task allocation due to decentralized control but the performance drops when robots act in the absence of organized coordination, especially when the environment is clustered or unbalanced. The biologically inspired behaviors in SwarmSim2 and MegaSwarm simulators were pheromone trails, recruitment, autonomic pulse communications and fault-tolerant sensing. Although these studies were able to define significant concepts, they were mostly restricted to case-based illustrations and statistical observation of one-off situations. In this paper [10], a research quality experimental framework is built on top of MegaSwarm that allows systematic and reproducible evaluation of recruitment strategies. Automation of batch sweeps of recruitment parameters, standardized metrics logging, and reproducible visualization output in the form of heatmaps, pheromone fields and time series charts have been added. The four recruitment modes, Off, OneResponder, MultiResponders and Blackboard, are tested with different swarm sizes and spatial layouts. This framework will turn MegaSwarm into an analytical tool to quantitatively study trade-offs between time, energy and communication in swarm recruitment.

The third paper is "Supervising Quality Environments with an Autonomic Ledger (SQuEAL)" [12] following on from [11]. This paper presents research exploring the potential for a mutually beneficial integration between the Quality Management System (QMS) and the paradigm of Autonomic Computing (AC). It includes a proof of concept demonstrating how such benefits may be realised. Specifically, the study proposes a corroborative, time-series blockchain-based ledger with autonomic capabilities, hereafter referred to as an Autonomic Ledger (AL). Selected, non-exhaustive background information from both paradigms is briefly reviewed to clarify how a conceptual relationship between them may be defined. A summary representation of the system design is seen in Figure 5 SQuEAL.

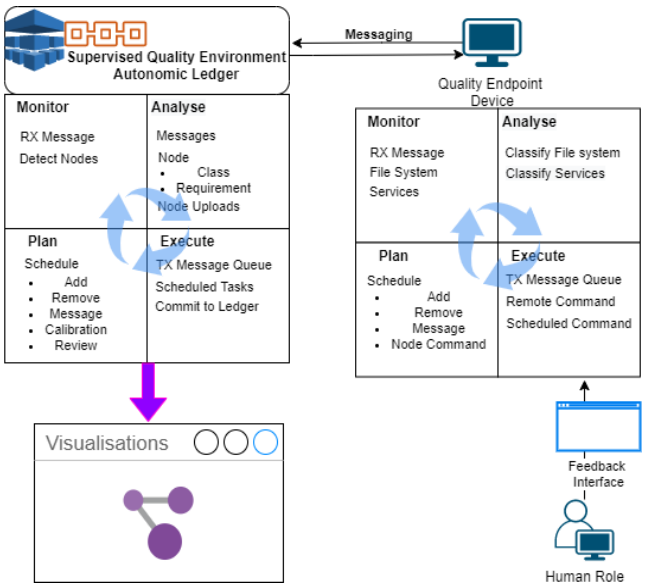

Figure 5 SQuEAL.

The fourth paper is "Agentic AI and the Autonomic Computing Vision: Continuity, Evolution, and Beyond" [13] This paper argues that Agentic AI not only carries forward but extends the original vision of Autonomic Computing. Through comparative analysis spanning control loops, autonomy, adaptability, knowledge representation, governance, and human roles, it illustrates conceptual continuity and key differences. The paper concludes that Agentic AI realizes many autonomic aspirations while introducing new challenges in safety, alignment, and system governance, while serving as a roadmap for researchers at the intersection of systems engineering and modern AI.

III. CONCLUSIONS

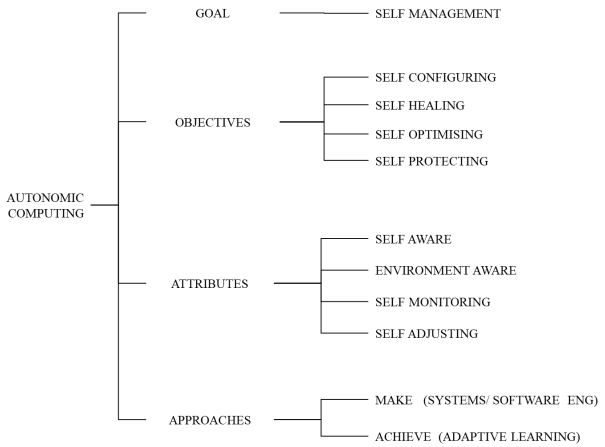

Figure 6 Sterritt's Autonomic Computing Tree [14][15]

The 2026 special session on *A.I. and Autonomic Computing* has continued to scratched the surface on the topic providing research examples of AC accelerated AI automation, with the aim to provide autonomy, learning and agency in their respective domain-bounded tasks.

Agentic AI may be the latest flavor in this drive, but we remind ourselves back in 2003 Sterritt had two "approaches" for AC on Figure 6 Sterritt's Autonomic Computing Tree [14][15] "Make (systems/software engineering)" and "Achieve (AI/Adaptive Learning"), and in an earlier version the approaches were "Engineer" & "Learn", along with AI/AC workshops and publications e.g.[16] [17] – all based on an interpretation of that original IBM vision for AC [2], which aimed to be a 20-30 year agenda. So as Autonomic Computing reaches its silver anniversary, not all is new but certainly we are able to fulfil some of that vision to a much larger extend now than then, due to GenAI.

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