Low-Code, No-Code, What's Under the Hood?

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Low-code and no-code is everywhere. Where does that leave the enterprise-level IT professional? This edition of IT Professional *reaffirms the role of the IT professional in a world where enterprise coders are being replaced by "citizen developers."*

BACKGROUND

IN the beginning, there was binary. Moving from mechanical gears to patch panels for register management, mechanical programming quickly gave way to "architecturally driven symbolic machine code," or assembly language. In the 1950s, assembly language managed the lowest level whereabouts of ones and zeros. Thus, modern computer programming based on symbol manipulation was born. Since the days of vacuum tubes, silicon took command and programming became increasingly sophisticated, reaching toward ever higher levels of abstraction. Available programming languages or dialects now range anywhere between 700[1] and 8945[2] worldwide. Needless to say, only about 50 or so reign supreme at any given point of time. Programming languages often specialize. For example, focuses vary from systems level, functional, object-oriented, aspect-oriented, agent-based, web-based, database, simulation, robotic, concurrent, quantum, graphical visual, and so on. Functional programming, such as Haskell,[3] by 1999 offered even higher levels of abstraction, avoiding many lower level programming details inherent in its predecessors. Functional programming was but a forerunner to low-code and even no-code programming.

LOW-CODE, NO-CODE

A low-code environment requires some programming acumen, while a no-code environment permits so-called "citizen developers" to assemble custom enterprise Software as a Service applications with little or no programming skills. These tools create an effective "what you see is what you get" (WYSIWYG) environment for process automation. This is somewhat analogous to a way that a child might compose Legos into a structure. Low-code and often visually managed low-code application platforms (LCAPs) are rapidly penetrating enterprise and manufacturing[4] environments.

The COVID-19 pandemic further fueled this movement with remote work mandates and as corporate responses to the looming shortage of qualified programmer/developers. This is evidenced by Gartner, which projects low-code and LCAP to grow by 22.6% by the end of 2021 over 2020 to a $13.1B valuation[4] and is projected to command 65% of application development by 2024. Forrester predicts that 75% of application houses will use low-code by the end of 2021.[5] Low-code, once the realm of singular platform providers, is also blossoming. Artificial intelligence (AI), machine learning (ML), and even robotic process automation (RPA) are pushing low-code into the world of increasingly autonomous software creation. While so augmented, the low-code fundamentals of abstraction, automation, and seamless connection make it attractive for migration beyond application assembly into applied data operations. This extends to storage management, cross-cutting integration, and big-data analytics.[6] This trend, in turn, promises to knock on the door of edge computing and the Internet of Things. Both Gartner and Forrester predict that low-code is here to stay and will continue to burgeon in the coming years. Trends toward autonomous code creation, however, also suggest that low-code may be eventually eclipsed by no-code.

The abovementioned analysis could easily be interpreted as a harbinger of the demise of the enterprise IT Professional. Momentarily, IT professionals remain valued for their expertise and analytic prowess in the enterprise. They are routinely tapped to be the real "citizen developers" on the front lines.[7] As low-code assembly becomes more straightforward and begin to scale or AI, ML, and RPA stitch workable environments together, will the IT professional be able retain such value within the organization? The likely answer is yes.

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To justify that answer, however, one must go under the hood to see what really makes the engine run.

WHAT'S UNDER THE HOOD?

While LCAP and no-code offer increased efficiency, they may not necessarily offer security. The threats to organizations from lone kiddy hackers to malevolent nation-state actors are increasing and no applications are immune from compromise. The reality is that most organizations are likely undercounting the attacks that actually occur.[8] Moreover, LCAP and no-code applications often rely upon networks, upstream data, and other applications that, when compromised, could introduce faulty data, or worse, other crippling vulnerabilities to the low-code or no-code applications or processes. Thus, there can be no lapse in cybersecurity vigilance whether corporate processes are composed by "citizen developers" or IT professionals. More importantly, proactive action is required rethink security in light of low-code and no-code, prevent the spread of bias and misinformation, and continually improve effective security defense mechanisms.

LCAP and no-code applications may or may not be interoperable. Most low- or no-code applications support generous links to open application protocol interfaces (APIs). If the target application is "home grown," it is dependent on a specific hardware configuration or does not support open APIs, and the ability to integrate it is compounded. Such legacy integration requires the skills of IT professionals.[9] Even if APIs are plentiful, the IT professional, with enterprise and industry knowledge may be required to integrate processes across corporate networks and to incorporate supplier, customers, and other external entities. More importantly, IT professionals remain best prepared to advice on corporate processes from the standpoints of best practices, security, and best business value.

As LCAP and no-code are infused with AI, ML, RPA, blockchain, and other advanced techniques, the knowledge of the IT professional becomes essential to better understand the risks associated with implementation of the advanced, but potentially opaque algorithms. The pace of technology advancement itself, such as quantum computing, assures that today's technology will soon become obsolete. This requires intimate knowledge of practical limitations and deep understanding of underlying logic to prevent algorithmic bias or false data from crippling the enterprise. This level of specialization, especially in the early absence of usable standards and safeguards, falls squarely in the realm of the IT professional.

As is also the case for digital transformation, astute management awareness is essential to systemic success where low-code or no-code is involved. It is one thing to compose a simple corporate process within an individual department but quite another thing to harmonize processes across horizontal lines. In addition to a driving vision to make this happen, senior managers and IT professionals must exhibit extraordinary soft skills to affect broadly based changes that have measurable corporate payoff. This is the stuff of the visionary IT mastermind.

All of the above point, not to simple process automation, but rather to interoperability at scale. While straightforward process composition by automated means certainly has a short-term payoff, the complexity borne of holistic corporate operations suggests far more must be bought to bear, especially if enterprises are to remain competitive in an ever more intertwined world. As corporate networks merge with their supply chains and networks intermingle, simple process automation is insufficient to deal with range of potential outcomes. In complex systems, emergence is commonplace, stifling rigidity and chaotic failure is always possible, and the whole is often far greater than the sum of its parts. From an IT standpoint, such phenomena swamp traditional reductionist or decomposition approaches to architecture. Rather, nonlinear techniques must be brought to bear to understand the threads of relationships. Here, cause and effect are decoupled by many intervening nodes, each of which has potential to affect the outcome. This is where world-class IT professionals must lead the way.

This edition of *IT Professional* takes a deep dive under the hood to reinforce the importance of the IT professional in a world of growing LCAP and no-code. Each article could well serve as a reference to bolster the key points emphasizing why the IT professional will remain essential to the corporate world.

THIS EDITION'S FEATURE ARTICLES

"Software Development Process Assessment With MMIS v.2, an ISO/IEC 33000-Based Model," by Rodriguez *et al.*, explores the use of the ISO/IEC 33000 family of standards for process assessment. The Software Engineering Maturity Model (MMIS v2.0) presented has a relationship to LCAP and no-code platform development as well as LCAP and no-code generated processes that become candidates for rigorous certification audits by IT professionals.

"Power and Performance Efficient SDN-Enabled Fog Architecture," by Akhunzada *et al.*, presents a

software-defined network (SDN) fog architecture that leverages cooperative and noncooperative policy-based computing. This architecture, designed to enhance high-volume traffic in SDN networks, exemplifies the level of SDN sophistication. Implementation and programming of such LCAP-enabling networks in the corporate world will certainly demand the skills of the embedded IT professional.

"Sensing-Based Analytics in Education: The Rise of Multimodal Data Enabled Learning Systems," by Giannakos *et al.*, explores the value of sensing-based analysis as a means of integrating multiple information sources to reinforce learning systems. As learning management systems enjoy a close relationship to LCAP, this article demonstrates another aspect of advanced process management that must be anticipated and managed by savvy IT professionals.

"A Supervised-Learning-Based Garbage Collection in Solid-State Drives," by Wu *et al.*, speaks to a novel means by which garbage collection may be managed by software within solid-state drives. While hardware architecture is removed from LCAP and no-code platforms, such improvements led by IT professionals at the corporate level serve to enhance process performance.

"CAPTCHA-Based Secret-Key Sharing Using Quantum Communication," by Han *et al.*, approaches use of the BB84 quantum key distribution secret-key shared protocol in concert with image-based Completely Automated Public Turing test to tell Computers and Humans Apart. This is the sort of protocol melding that will eventually find its way into enterprise computing requiring implementation and astute corporate security monitoring.

"Toward Trustworthy Urban IT Systems: The Bright and Dark Sides of Smart City Development," by Park and Chung, takes a broad view of the opportunities and pitfalls of future urban design requiring interoperability at scale among numerous interacting agents. It demonstrates the level of complexity facing large-scale municipal implementations and closely mirrors similar corporate challenges.

THIS EDITION'S COLUMNS AND DEPARTMENTS

"Formal Methods Boost Experimental Performance for Explainable AI," by Gossen *et al.*, looks at a means of gaining understanding of AI heuristics and hyperparameter tuning through the imposition of formal methods. This article speaks directly to the details, the means by which what's under the hood in AI can be better appreciated.

"Wake-Up Calls for Reluctant C-Suite Executives," by Andriole, speaks to the heart of why corporations must move from complacency to activate technological engagement in areas such as AI, ML, RPA, natural language processing, blockchain, automated supply chains, 3D manufacturing, and other disruptive technologies. The article looks across industries, and offers ample justification as to why IT vision and drive are so important to the corporate C-Suite for successful branding and integrity.

"Blockchain-Based Smart Contracts to Provide Crop Insurance for Smallholder Farmers in Developing Countries," by Kshetri, takes an analytical look at blockchain-enabled smart contracts for crop insurance. As smart contracts will likely become more prevalent in corporate processes, this insightful article is important and again reinforces the role of the IT professional. This article also suggests a potential of low-code or no-code use in developing regions.

"Mitigating Disinformation and Building Trust in Social Media," by DeFranco *et al.*, offers the use of blockchain technology to help mitigate the flood of misinformation flowing through media, and especially social media. As in the previous article, this article again defines pervasive issues with data integrity issues and offers an advanced technology solution worthy of IT professional stewardship.

"Masterminds of the NSFnet: Jennings, Wolff, and Van Houwelling," by Strawn, once again anchors the role of visionary leaders in developing and harnessing new technologies. This is really the message underlying adaptation to all new technologies; LCAP and no-code are no exceptions.

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