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Enabling UiPath Maestro for Agentic Automation: Orchestrating Bots, Ai Agents, and Human Users

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ABSTRACT

With UiPath Maestro, agentic automation can optimize complex, unstructured processes that traditional rule-based automation couldn't address. While conventional automation has been adept at handling structured and repetitive tasks, agentic automation can handle complex decision-making processes that can adapt in real time. This research paper mentions the UiPath Maestro Platform, its features, and how they can be used. These features include process modelling, process implementation, process operations, process monitoring, and process optimization. Also, this paper mentions AI agents and how they help address the challenges faced by traditional RPA robots. By unifying agentic AI, automation, BPM (Business Process Management), and process intelligence, UiPath Maestro gives organizations total control to design, run, and optimize new agentic processes. Using Maestro, users can create processes with standard BPMN constructs, like tasks, gateways, and events, or leverage Autopilot to accelerate model creation. Maestro enables effortless agent adoption, seamless process performance, and simplified process management. Business users can drag and drop BPMN components in the canvas while the developers can later plug RPA workflows. Using process dashboards, business users can view the real-time status of ongoing processes, identify bottlenecks or delays, and reassign failed tasks. As business users can document requirements, policies, and business rules within the process model, the back-and-forth between business and developers can be reduced.

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Introduction

RPA has evolved throughout history to free human users from repetitive tasks, but it still requires human intelligence and dynamic decision-making in its execution. To address this challenge, Agentic automation comes into effect through a combination of features under Maestro [1]. UiPath Maestro is a Process orchestration platform that lets users manage all kinds of automation involving AI agents, bots, and human workers. It enables organizations to design, execute, monitor, and optimize long-running business processes involving the previously mentioned types of automation. Agentic AI is a technology that leverages new forms of AI like LLMs (Large Language Models), traditional AI such as machine learning, and enterprise bots to create AI agents that can perform process automation with decreased human intervention [2]. Agents don't replace RPA robots but instead complement them. These agents are capable of decision-making and improving with each iteration. These AI agents are highly adaptable to changing environments and triggers. In large enterprises, there are often two kinds of processes: deterministic processes, which follow predefined rules and are predictable, and nondeterministic processes, whose outcome varies based on human judgment or specific triggers. Large organizations often use numerous applications, from legacy to modern cloud-based systems, to complete a process. Inefficiencies include siloed data across the applications and interfaces, nonstandard processes across departments, and poor integration of internal systems with external provider systems. This complexity limits the visibility of those kinds of processes. For example, tracking the patient admission process in a hospital might involve various applications, teams, and sometimes vendor applications for lab tests, making it challenging to monitor process KPIs and identify bottlenecks accurately. Although Artificial Intelligence is being incorporated into the workflows to improve efficiency, many organizations face challenges in continuously monitoring, learning, and optimizing workflows across their life cycle. Using UiPath Maestro, organizations can manage and orchestrate long-running processes across AI agents, robots, and people, supporting the entire life cycle process, including process modelling, implementation, operations, and optimization.

Orchestrator, among many other functions, helps manage UiPath bots, customizes insight dashboards, enables asset modification, and monitors bot logs in case of failures [3]. In contrast, by combining process data, task-level data, and AI agents' interactions, UiPath Maestro is not limited to managing features or functions in Orchestrator but can orchestrate, govern, and monitor processes that involve UiPath bots, AI agents, human users, and external vendor systems. Maestro helps increase the performance of automated systems and the digital workforce, and gain an in-depth understanding of processes by combining process, task, and automation-level data. Usually, a pictorial or visual representation of a process can be realized using diagrams in Visio. However, when a BPMN (Business Process Model and Notation) model is designed in UiPath Maestro, it is not just a static diagram but an

executable process that may entail actions performed by bots and users. The first step is to drag and drop shapes like start event, bot task, human in the loop approval, etc. The second step is to define who performs each task. Deploy BPMN model as a live workflow, which Maestro's execution engine will orchestrate. As per the steps in the BPMN flow, bots, AI agents or human interventions are triggered. For example, if a step in the flow is assigned to a UiPath Bot, Maestro sends a token request for the task to Orchestrator, and then a bot is assigned to perform that task. After execution, the bot returns data and proceeds to the next step in the BPMN flow. It is UiPath's platform for enabling agentic automation. Agentic orchestration is the unique ability to coordinate long-running, complex business processes across AI agents, robots, tools, and human users. This research paper discusses the essential functions of Maestro, an orchestration tool for bots, AI agents, and humans [4].

Process Modelling

Creating an Agentic Process in the Automation Cloud by following these steps: Go to the Automations Page in the studio web, click create new on the upper right side of the page, and click on agentic process [5]. The project corresponding to the Agentic project opens, and each project consists of multiple agentic processes. Multiple agentic processes can be added to a project, and then the start event can be assigned to any BPMN process based on the business logic. The designer is like the drag-and-drop feature of Visio, built for complex and enterprise-wide automation. Using canvas allows users to model tasks, define actions, add agents, include humans if necessary, and handle exceptions. These steps will be modeled in Canvas. It is not a diagram but an executable flow. Some elements function as events that control process executions, and some others act as placeholders for activities and workflows. Links between the elements are connected using arrows, giving meaning to the flow. Every agentic process starts with a start event element, and other events can be added by selecting from the designer panel at the left. The categories of elements of the toolbar are gateways, tasks, events, data, and participants. Tasks are used to accomplish what needs to be done by UiPath Bot, AI agent, human, and system/API. Gateway is a decision point in the process, routing the workflow based on business logic. Exclusive gateway takes only one path (either /or), parallel gateway takes all paths using AND logic, and Inclusive gateway takes one or more paths – each path can be assigned to one agent. Event triggers, such as pause, resume, or end mark key moments in the workflow lifecycle. Data type represents variables, inputs/outputs, or context passed between tasks. In Maestro, data is created by tasks, passed from one element to another, and is used as a decision point. Participants are roles in the process, and they can be human users, robots, AI agents, or external systems. To organize BPMN, swim lanes can be created for each participant. The validation panel is available at the bottom left of the BPMN diagram. The panel depicts number of validation errors in the process. By selecting the warning icon, the panel directs the user to the affected element in the designer. The following are the menu options: Import from file to import .bpmn file in the project, download the file to export BPMN model in the canvas, organize connections to rearrange all connections in the designer to improve readability, show/hide validation errors, undo the changes previously performed and redo the action that was previously undone. The context menu in Maestro appears when the user right-clicks on the designer. Two options will be displayed: organize connections and show/hide validation errors. Right-clicking on an element generates four options: rename, copy, cut, show properties pane, and remove.

Process Implementation

Agentic Process automation can be configured on the canvas in the Studio Web with instructions. Maestro models can be implemented, tested, and deployed in the Studio Web. The Properties panel has features that are useful for configuration [6]. The XML tab is primarily used for support purposes. The General section has the option to define a name and description. Input is required for the job to start. When the Start event in Maestro is specified, input fields should be given for the process to start. If the input is not passed, the job will not start. An option is to add outputs for a selected element, which will be available as variables or expressions. Tasks are building blocks of BPMN workflows in Maestro, and each type of task will help integrate different parts, including UiPath and external systems, into the process flow. Service Task is used to call for the execution or wait for the completion of the execution of an action. UiPath bots, AI agents, or queues can execute the task. User Task is like a human-in-the-loop action, pauses the automation, and waits until the human acts. For example, staff must manually verify the discharge summary created by the AI agent before uploading it to the Electronic Medical Record system (EMR). Send Task is used to call an external system synchronously. Receive Task waits for a trigger from an external system. Business Rule Task executes a business decision model stored in the orchestrator. Gateways are also available for process flow control: exclusive gateway chooses only one path based on a condition, inclusive gateway chooses one or more paths simultaneously, parallel gateway executes all paths in parallel, and event gateway waits for one event from multiple possibilities. Start events are where the process starts, intermediate events are where something happens in the middle of the process, and end events are where the process ends. Using Sub Process, multiple processes can be grouped into a single big process. Debugging in Maestro is possible before a process is officially deployed to production. Debugging is all about testing and troubleshooting BPMN processes.

Process Operations, Monitoring, and Optimization:

The process overview section provides an operational overview of all the processes in a dashboard [7]. The dashboard for all active instances has information broken into two segments: running and faulted. The incidents table has all the information related to the faulted instance and is grouped by error message per process and time elapsed since that error was first encountered for that process. The process table lists all the instances the user can access in the tenant. The instances with different statuses are running, faulted, and total instances. All instances view displays a list of all instances of a selected process, letting the user analyze and monitor each execution. Single instance view gives a detailed diagram of a specific process instance, presenting each step's execution status, input/output variables, and action in history. This is very helpful in debugging and understanding the flow. Necessary roles and permissions can be given to ensure users have appropriate access based on the role. Hitting pause on a process instance temporarily halts the process after completion of the current step, resume continues the execution from where it's paused, retry restarts the process from the last completed step after a failure, cancel stops the execution, and migrate updates the process instance to a newer version. Process overview summarizes the status of all processes, depicting the issues and bottlenecks, analytics option offers a visual representation of process metrics, diagram view visualizes the process flow and execution paths, and process-level dashboard provides detailed statistics and KPIs for individual processes, helping in performance assessment and optimization. Process monitoring within Maestro offers insights into the historical execution of the processes, and the data will be

provided on historical executions, including incidents, completion of instances, faulted elements, and outliers for elements. Also, a heatmap puts the elements' duration in the context of the entire process flow. The green check mark represents successful instances, the red exclamation point represents the failed instances, and the blue circle next to the human tasks represents several processes under escalation review. Some of the KPIs are number of traces depicting total number of process executions, number of variants mentioning different process paths, average trace time representing duration of process executions, conformance rate that gives percentage of executions adhering to the reference model, automation rate representing proportion of automated events in the process, first time right represents processes completed without any revisions, and straight through processing that mentions percentage of processes completed without manual intervention. Process Tracking service records the execution steps of the agentic processes and captures the causality between automations across UiPath Platform, including Integration Service, Action Center, Document Understanding, Jobs, and Queues. Unified View provides a consolidated view of process executions, providing better understanding and analysis. The tracked data can be mapped with Process Mining, allowing for even more advanced analysis and optimization. By analyzing this tracked data, we can identify bottlenecks and areas of improvement for the processes.

Artificial Intelligence (AI) Agents in UiPath

AI Agents and Agentic Automation elevate traditional Robotic Processes to new levels of intelligence. UiPath CoPilot has a suite of AI-powered features in the platform. Using CoPilot, workflows can be generated, code can be retrieved, and fixes to the code can be made in case of errors before compilation. In classic RPA development, building an automation is a manual process—developers drag and drop activities, write scripts, and invoke code. Autopilot's Generative AI feature expedites this process, reducing development time. This feature is available both in UiPath Studio and UiPath Studio Web, letting even non-technical users create automations with simple natural language prompts. For instance, when the user types "Get the code, using LINQ queries, to filter the data table dt_inputdata based on certain data in a column", the prompt the user receives will have the LINQ code to perform the required task. This eliminates the time for research and code building. The AI-generated code must be debugged to check if it works for the condition. Also, CoPilot provides assisted recommendations, such as best practices or optimizing workflows, effectively performing the role of co-designer. Even complex expressions can be generated by simple natural language prompts. There are some key aspects in which traditional RPA differs from Agentic Automation (AI Agents + Maestro). Traditional RPA bots excel at repetitive, rule-based tasks but struggle with complex decision-making. In such cases, human judgment is required. However, AI agents leverage ML models, reason, and decide autonomously without human intervention. For instance, AI agents can analyze an email or a document and classify it accordingly. By incorporating context-aware features, AI agents fill the gaps in workflows that previously required manual intervention [8].

Conclusion

In summary, organizations, going forward, use Maestro, and this usage doesn't mean that bots will be decommissioned. As traditional bots alone aren't sufficient for complex flows involving AI and humans, agentic automation, a combination of AI agents, RPA bots, and human intelligence, will be implemented under Maestro, an umbrella of features mentioned. However, there's a difference between Gen AI and Agentic AI. While GenAi takes input from human users and generates content, Agentic AI, on the other hand, is action-oriented, going beyond content creation to empower Bots towards independent decision making and actions. AI agents are reshaping industries by streamlining processes and freeing human users from repetitive, rule-based tasks. In healthcare, they assist with diagnostics, data management of patients, planning of treatment, and monitoring patient vitals remotely. While AI agents offer numerous benefits, some challenges come with them and must be addressed. One such concern is related to ethics and privacy. AI agents rely on large datasets containing sensitive information to make accurate decisions. As the data will be used to train and improve performance, firms must establish robust data governance frameworks to ensure AI agents meet guidelines, such as GDPR or HIPAA. As AI agents use historical data to make decisions, they will be less effective when encountering a novel situation. Hence, firms must have the required mechanism in place for human oversight to handle complex or unpredictable scenarios.

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