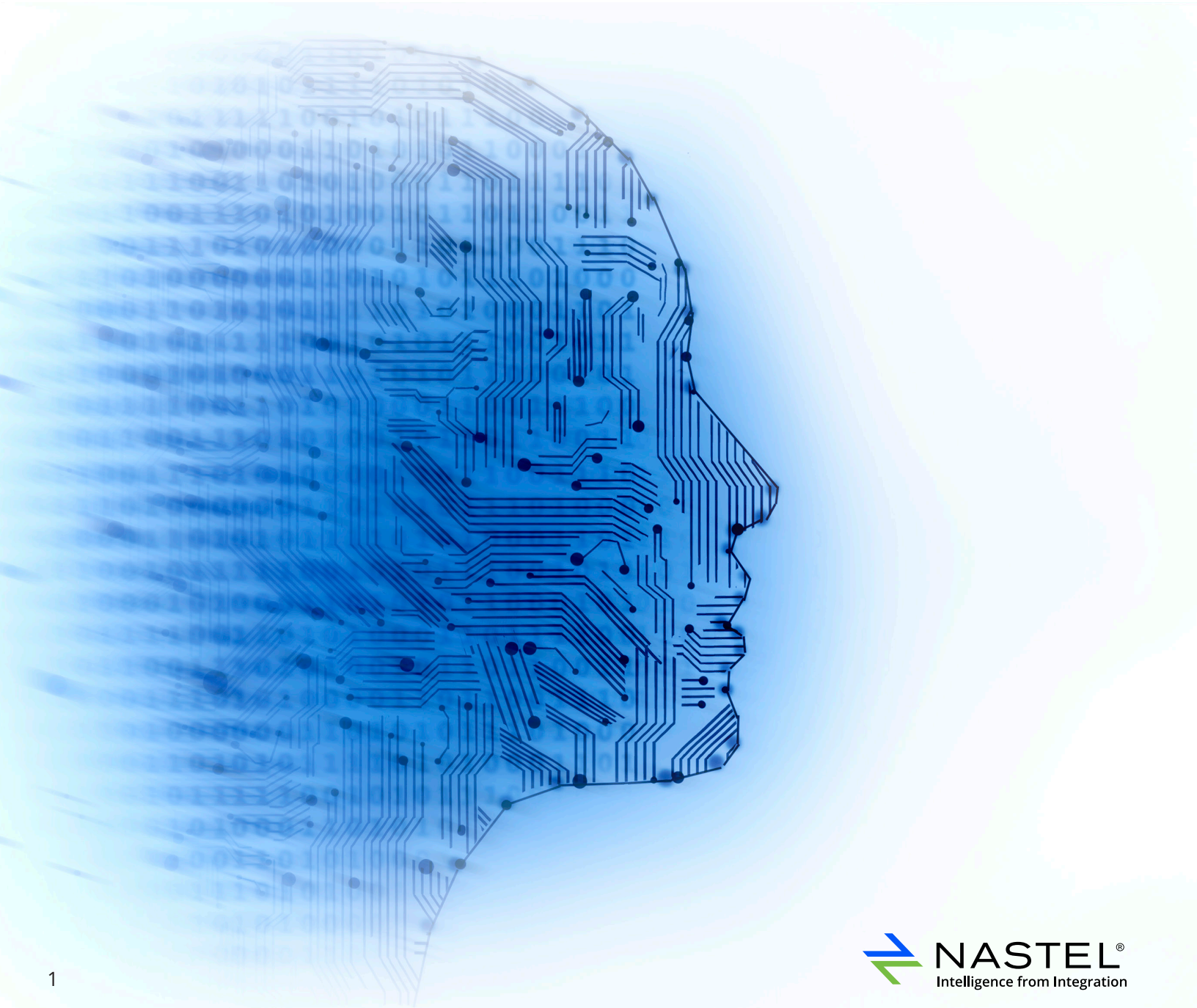
NASTEL®
Intelligence from Integration

White Paper

What is Integration Infrastructure Management (i2M)?



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Introduction:

At the time of writing this paper in early 2022, the internet is believed to be more than five trillion megabytes in size. And its rate of growth is increasing, with some pundits postulating that the www element of the internet alone is growing more than 3000% annually.

Every business today is an e-business, with everything from logistics, stock management, order processing and manufacturing to sales, marketing and finance being digitized and operated by computers spread around the globe. We all rely on fully virtualized cloud-based systems connected in complex patterns. Legacy, contemporary, and leading-edge concepts are all used cohesively, with datacenters, mainframes, cloud computing and edge computing using a mix of proprietary and customized applications working with public and private SaaS applications to enact every service and business.

Today a single smart phone contains over one hundred thousand times more processing power than was available to the entirety of NASA to send Apollo 11 to land on the moon and return it to Earth.

When you order groceries to be delivered tonight, you are “hooking” into an enormously complex architecture that spans the globe and uses more technology than even existed on Earth a dozen years ago. And the fact that your frozen chicken cutlets arrive on time and still frozen at your door took the combined work product of millions of people.

It is now literally impossible for a single person or team to fully understand the technology being used to deliver a business in enough detail to deal with performance, availability, and security. With layers of technology built upon layers of technology the task to manage the platforms, infrastructure, and applications effectively is enormous.

The Unacceptable Choice - Increasing Risk or Delaying Speed to Market.

As the complexity of integration infrastructure (i2) grows, classic methods of submitting change requests via a ticketing and administrator model lead to a “bottleneck” in the process of delivery.

Often there will be too many changes to manage with the given resources, and the decision to increase risk by skipping steps in necessary processes or requiring more time to deliver the required changes (more than the agreed service levels) will have to be made. Neither option is ever acceptable to the business.

When the number of Requests For Change exceeds the available capacity of the team and the systems and processes they must use, then the choice is:

1. Increase the risk to your business by breaking your processes (skipping steps or not completing a step effectively). Missing the steps means compromising security and robustness leading to outages or theft.
2. Delay delivery of updates or new applications by following process but missing mandated deadlines. Delaying time to market costs millions as competitors take your business e.g., Betamax vs VHS.

Neither of these options is ever acceptable to the business. They could cost millions and mean the end of the company, so a strategic change is needed to prevent these situations.

360° Situational Awareness

As the scale and density (complexity) of technology continues to increase, the ability to quickly and completely understand how each part of the system affects results and affects the experience of users of the systems becomes increasingly difficult. The technology isn't just growing. It's changing on a daily or hourly basis. Sometimes even faster. It's not just scalable, it's elastic. Advertising companies resize their infrastructure every 15 mins to handle commercial breaks in popular television programs.

The mathematical relationship with managing integration is "exponential". What this means is simply that the effort to manage the integration of ten items is not ten times the effort to manage one integration, it's closer to 1000 times more complex.

There is a hierarchy of technology that is often used to effectively understand and control operations and to provide situational awareness.

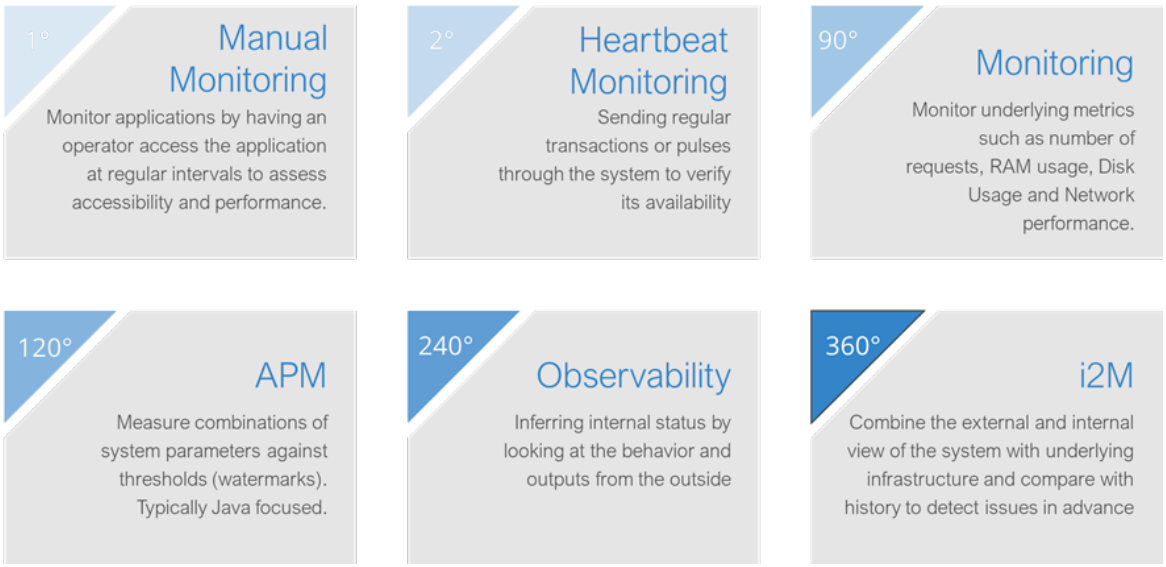

Figure 1- 360° Situational Awareness

For large scale enterprises that demand complete 360° visibility (also known as Situational Awareness) then integration infrastructure management (i2M) is required.

Without i2M, the complexity of managing integration infrastructure creates either increased risk or delays in delivery (speed to market).

i2M Defined

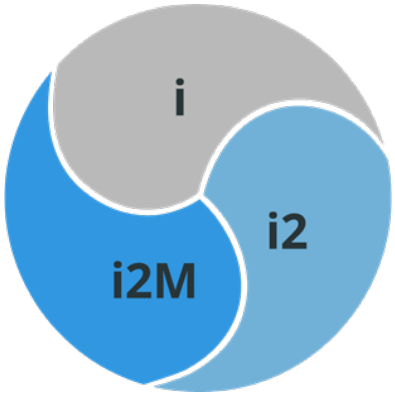

Figure 2 Integration, Integration Infrastructure, and Integration Infrastructure Management

i - What is Integration?

Integration, from Latin integrat- 'made whole', is the act of bringing together different things into a larger combined thing.

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From the creation of the very first programmable computer (Charles Baggage 1781- 1871) and the first programming language (created by Lady Ada Lovelace 1815-1852), the challenge of effective integration has been a part of IT life.

That very first computer was a physical device made up of intermeshed cogs and levers. Even though every cog was made within the defined tolerance, it failed to run as expected, because of the complexity of integrating the immense number of moving parts.

This is today's challenge as well, each system can be running within its expected parameters and yet the result can be delays, slowdowns, errors and availability issues experienced by the consumers of a business process. Identifying problems that are created by a combination of multiple systems interacting close to their performance or capacity limits is complex, time consuming, frustrating, and very expensive.

Every system built since the very beginning of IT has seen this same concern.

Integration engineering is complex, time consuming and critical for the successful functioning of each defined process.

Abstraction

The basis of all Information Technology is the combination of discrete elements into workable processes.

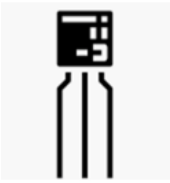

Figure 3 Chemical elements such as silicon and gallium are used to create transistors.

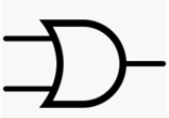

Figure 4 Transistors are connected to form logic gates and memory circuits.

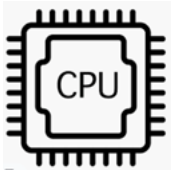

Figure 5 Billions of logic gates are connected to form the logic in silicon chips that provide all the functions of CPU's and memory.

Figure 6 Silicon chips are connected to form computers.

All these levels of technology are built upon the layers below them. This way of thinking is often referred to as ***abstraction*** and is the basic thinking that allows massive numbers of elements to be combined and controlled into more complex systems.

Low-level and high-level Programming languages and then programs are the abstraction building blocks on top of the infrastructure components and physical and virtualized platforms (that IT manage), that are the tools of application development.

Trillions of components and trillions of lines of code and many trillions of bytes of data must be integrated and connected in useful ways.

i2 - What is Integration Infrastructure?

Integration infrastructure is anything that performs or facilitates the integration.

Standards have been developed to allow the huge array of technologies, programs, and data to be integrated. Some of these standards describe the physical requirements of voltage and frequency, while others describe how devices, appliances and applications can share information using protocols, and rules.

These higher layers of abstraction allow vast amounts of technology to be controlled with higher levels of technology which are dependent upon reliable integration.

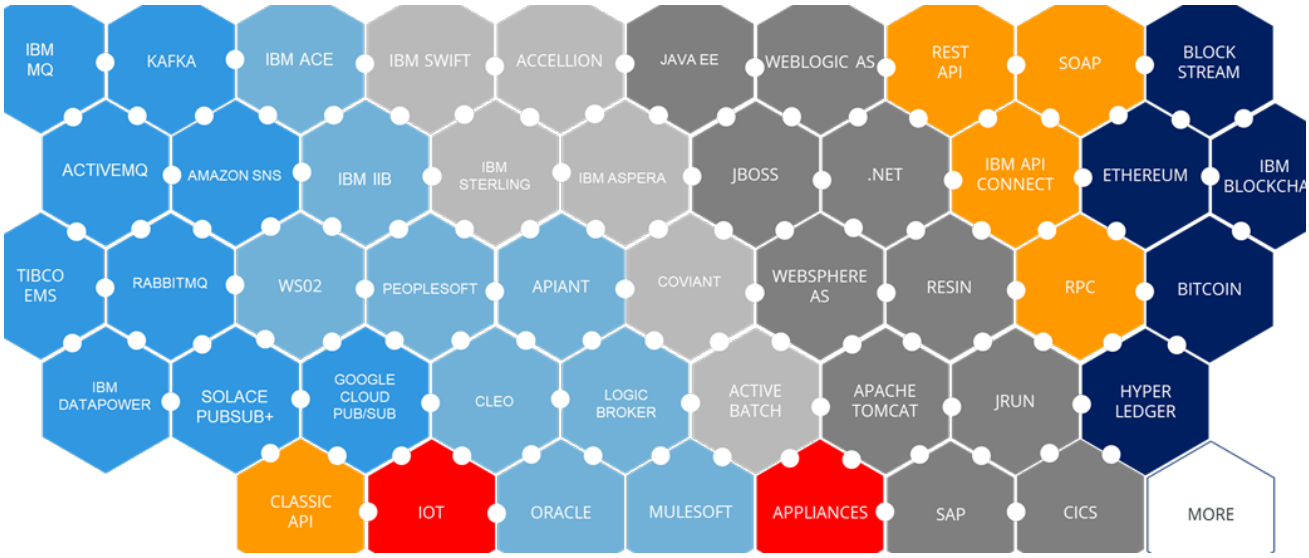

Figure 7 Examples of some of the most common forms of integration infrastructure

The most common integration infrastructure technologies used in enterprises nowadays include IBM MQ, Apache Kafka, Solace PubSub+, TIBCO EMS, ACE/IIB and also emerging are RabbitMQ, ActiveMQ, Blockchain, and IOT.

Tempus Fugit

Time is a critical factor in integration. Some parts of a process will inevitably work faster or slower than other parts. And with potentially billions of interactions taking place in parallel every second, keeping track of requests and ensuring that every request is serviced correctly is a complex, yet critical part, and this part is handled by the integration infrastructure, (which includes messaging middleware).

The integration infrastructure is the IT equivalent of the body's nervous system, the pathways that both provide the ability to send controlling information, and to get information about how each part of the system is performing. In the body the nerves tell muscles how to move, and organs how to work, and at the same time provide information about senses (touching, tasting, hearing, seeing, smelling). And

the integration infrastructure provides the same services across IT.

Integration Infrastructure (sometimes referred to as “middleware”), and the specific type of integration infrastructure associated with connecting applications together is generally referred to as “messaging middleware”

i2M - What is Integration Infrastructure Management?

Integration infrastructure management is the act of looking after the integration infrastructure. This can include supporting it from the point of view of security, performance, configuration or availability. In the IT world it includes management of applications, the technology that connects them and the data that flows between them.

While the body’s nervous system is the result of evolution, IT requires design (some may say intelligent design) and this requires integration infrastructure management or i2M.

Ensuring that the integration infrastructure rules are established perfectly is critical to ensure high performance, high availability, and an acceptable (and maybe more appropriately, exceptional) user experience.

As the processes being managed become more complex, then the complexity of managing the integration infrastructure grows at a geometric rate. While the integration between two systems can be quite easy to visualize and to set up rules to integrate, when you are dealing with thousands of separate systems that must be integrated together (and each integration may have to handle hundreds of steps), it becomes a complex, time-consuming and expensive task, and it becomes critical that advanced i2M is implemented.

Without i2M the complexity of integration becomes a burden on the business, and many organizations find that their integration engineering teams end up missing their agreed delivery schedules, service levels or quality targets, and this leads to delayed updates and delayed new implementations, which in turn impacts the business's key performance metrics.

There are many ways companies have tried to address the need for i2M, by trying to repurpose legacy monitoring solutions, throwing additional people at the problem or even trying to build their own i2M systems in-house. As systems continually grow in complexity, none of these approaches lead to satisfactory long-term results.

What is needed is a strategic approach to managing all forms of integration infrastructure (i2) in a way that ensures scalability and quality. This strategic approach should consider legacy, contemporary and future states of the infrastructure, and be able to deal with all types of platforms and applications. Your integration infrastructure of choice today may be IBM MQ or ActiveMQ, but tomorrow it may be Kafka or some blockchain based service. You may be using AWS today, but you may need to also use Azure, Google (GCP) or IBM (IBM Cloud) tomorrow. And as your business requirements change, your legacy systems do not magically go away, they form part of your architecture and must continue to be integrated with newer contemporary and even leading-edge technologies.

A strategic approach to i2M must provide a consistent method of managing across all forms of infrastructure, platforms, and applications. And i2M must provide scalability, allowing those tasked with managing integration infrastructure to be able to provide private, secure self-service to developers to ensure maximum operational agility.

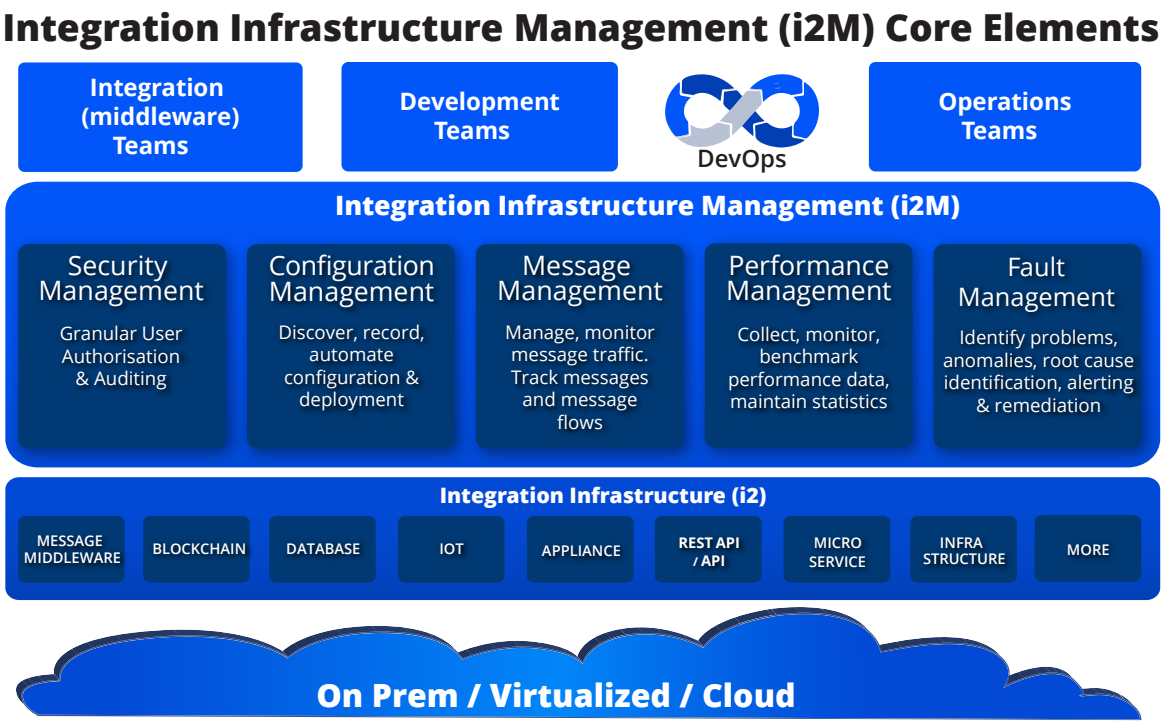

Figure 8 i2M Architecture Blueprint

Security Management

Security continues to be a moving target for enterprises of all sizes. A physical or logical intruder just needs to find one weakness to invade a system, while those responsible for securing a system must ensure that there are no weaknesses.

It will always be easier to be the needle than the haystack.

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i2M provides several additional vectors for security teams to use to enhance security and privacy and at the same time recognize unusual behavior.

There are normal pathways that a legitimate user can be expected to follow when accessing a business application, if elements of a process are accessed in an unusual order, this can be an indicator of an intrusion. i2M can be used to detect accesses that did not follow the prescribed pathway through the system and alert the security teams to investigate.

i2M can also provide federated security access to specific functions for specific sets of users, ensuring that even when complex businesses processes are to be managed, security governance can be maintained.

Performance Management

Performance management is the process of ensuring that a set of activities and outputs meets an organization's goals in an effective and efficient manner.

Performance issues can often be the result of multiple systems interacting in unexpected ways. Each individual system may be performing within expected levels, but the results experienced by users can end up being outside of expected service levels. These kinds of issues historically resulted in all the operations teams associated with all the elements of the process holding a "war room" meeting, where everyone present would debate the causes of the issue. These meetings would be long, expensive, and often did not lead to a satisfactory resolution. Using i2M, enterprises can visualize each user's experience, and overlay the performance and operations data of each associated system allowing the entire user experience to be understood holistically and compared to other similar groups of users' experiences to quickly see exactly what combination of events is leading to this specific performance issue. The result is significantly faster root cause analysis and remediation, and a virtual end to war room meetings. For many companies i2M allows performance management to become predictive, and the early subtle indicators of performance events can be used to avoid the events entirely. Machine Learning AI and Automation are used to alert operations of potential events and allow suitable remediation to be delivered with the press of a single "accept" button.

i2M looks at performance end-to-end and provides the ability to drill into each system's performance to discover exactly what needs to be adjusted to improve performance.

Instead of looking at each system discretely, i2M allows processes to be visualized holistically. An operator can group similar engagements (transactions) together by whatever criteria is most appropriate and compare groups or individual engagements together manually and with machine learning artificial intelligence (ML AI) to gain fast, accurate and meaningful knowledge relevant to improving the business.

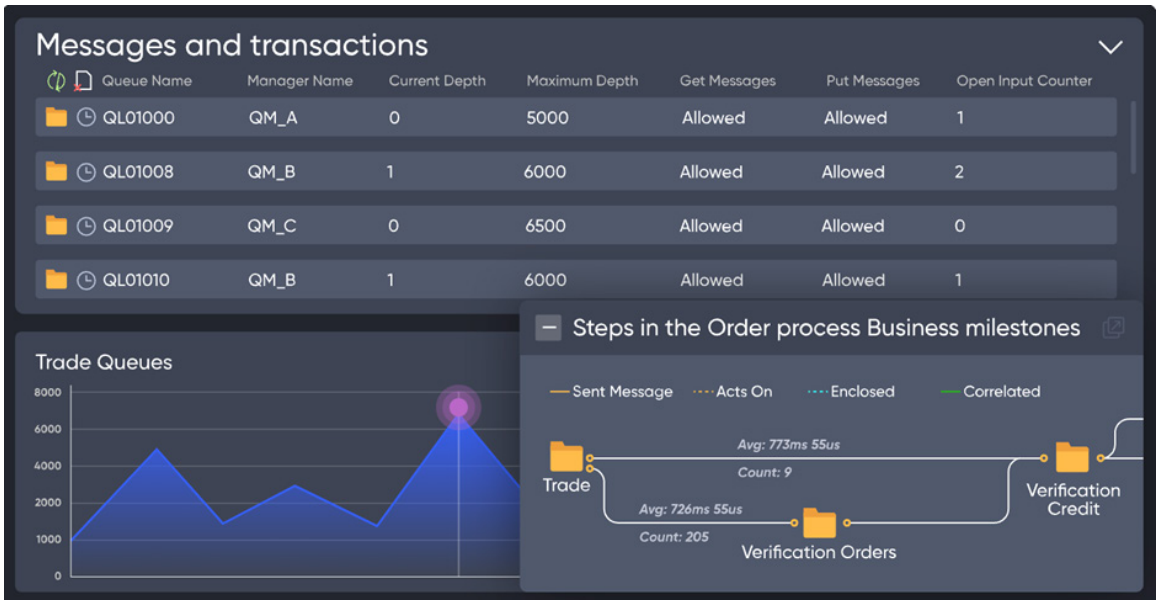


Figure 9 Example of i2M visualizing performance

Message Management

Messaging Middleware systems are a critical part of the integration infrastructure. Ensuring that required changes to the configuration of these systems happen quickly, reliably, and securely becomes a lot easier with i2M. With i2M messaging middleware systems that span multiple platforms (e.g. distributed, mainframe, cloud) and that span multiple variants (e.g. IBM MQ, Kafka, Tibco EMS) can now be managed centrally by a small administration team, yet can be operated by individual developers or QA staff (or groups) with federated and secure private access to just the queues, streams and messages they are authorized to control.

Configuration Management

Configuration management (CM) is a systems engineering process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design, and operational information throughout its life. The CM process is widely used by military engineering organizations to manage changes throughout the system lifecycle of complex systems, such as weapon systems, military vehicles, and information systems. Outside the military, the CM process is also used with IT service management as defined by ITIL, and with other domain models in the civil engineering and other industrial engineering segments such as roads, bridges, canals, dams, and buildings.

i2M streamlines the process of CM (Configuration Management) in integration infrastructure(i2), by providing a standard method of accesses, interrogating, reporting and controlling all of the configuration management across the entire i2.

Self Service Development

When we look at the interconnectivity of CI/CD (continuous integration/continuous delivery processes) with integration infrastructure, there is a concept of self-service. You can think of self-service as a method of allowing consumers of a process direct access to that process through an ergonomically defined interface, while the administrator maintains the ability to direct how they may use the process algorithmically. Self-service orchestrates integration infrastructure through the CI/CD process. Using REST API's (for example), self-service can be used within an orchestration platform to deliver automation of previously complex manually operated functions.

Now, imagine being able to deploy an application and having it go through the CI/CD workflow. As part of that, you can create multiple cues on certain topologies, and all of that is automatically deployed to Azure, AWS, a hybrid cloud, or even on-premises. Self-service is a dual role. One is for administrators and developers to do things when they need to. The other is to automatically integrate into the CI/CD pipeline for complete automation.

Integration As Code

With the rise of DevOps and CI/CD pipelines, it's easy to look at everything as code. Applications are already built from code, but infrastructure can now be seen as code, too. Why not integration as code?

When you deploy artifacts, why does it have to be a manual, user-based process? With today's technology, it is possible to deploy integration infrastructure the same way you would deploy an application.

Fault Management

Fault management is the set of functions that detect, isolate, and correct malfunctions in a system, compensate for environmental changes, and includes maintaining and examining error logs, accepting and acting on error detection notifications, tracing and identifying faults, carrying out sequences of diagnostics tests, correcting faults, reporting error conditions, and localizing and tracing faults by examining and manipulating database information.
Through its unique understanding of the i2 systems, i2M can present a complete

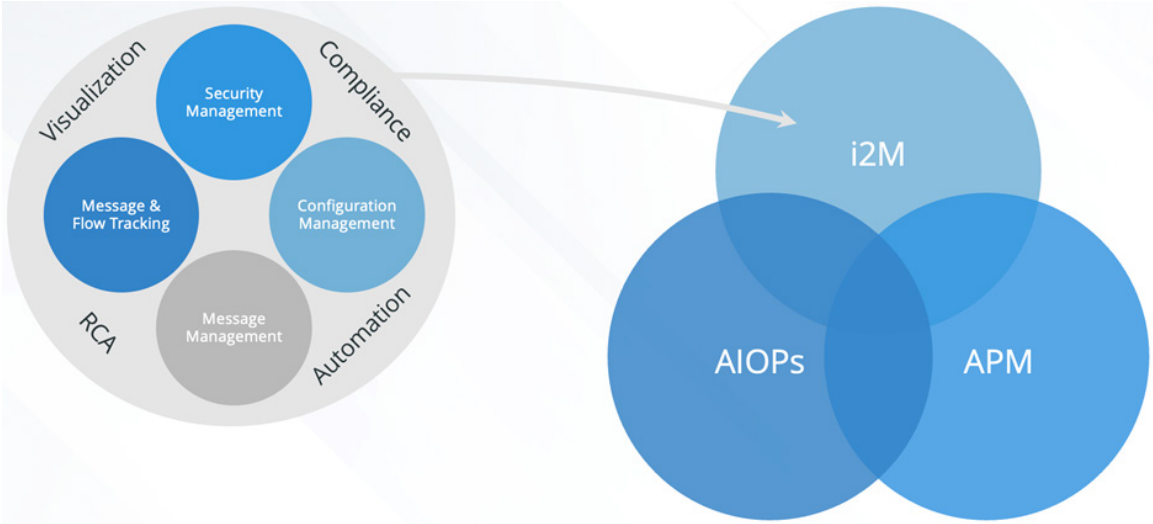
end-to-end visualization of each engagement that presented either a fault or a series of data points that are indicative of a future fault. This allows the operations team to recognize when multiple systems running close to their capacity could together create a fault, while individually each may not be reporting a fault (a very common, complex issue that is very hard to diagnose using classic thinking).

i2M simplifies and improves the speed of root causes analysis, and virtually eliminates the need for war room type conference calls.

i2M moves a business from reactive to proactive and predictive fault management.

i2M vs AIOps, APM, ITSM, ESM, SIEM, ITOps

I2M is the strategic approach to using the knowledge carefully curated within the i2 layer of technology to complement the systems that already exist to monitor performance, availability, and security. Consequently, managing i2 becomes simpler.



i2M complements the existing toolsets in use to complete the ability to deliver true 360° Situational Awareness.

Making intelligent use of integration by implementing integration infrastructure management (i2M) delivers 360° Situational Awareness

With this strategic vision and benefit requirements in mind, the choice of i2M becomes much more clear.

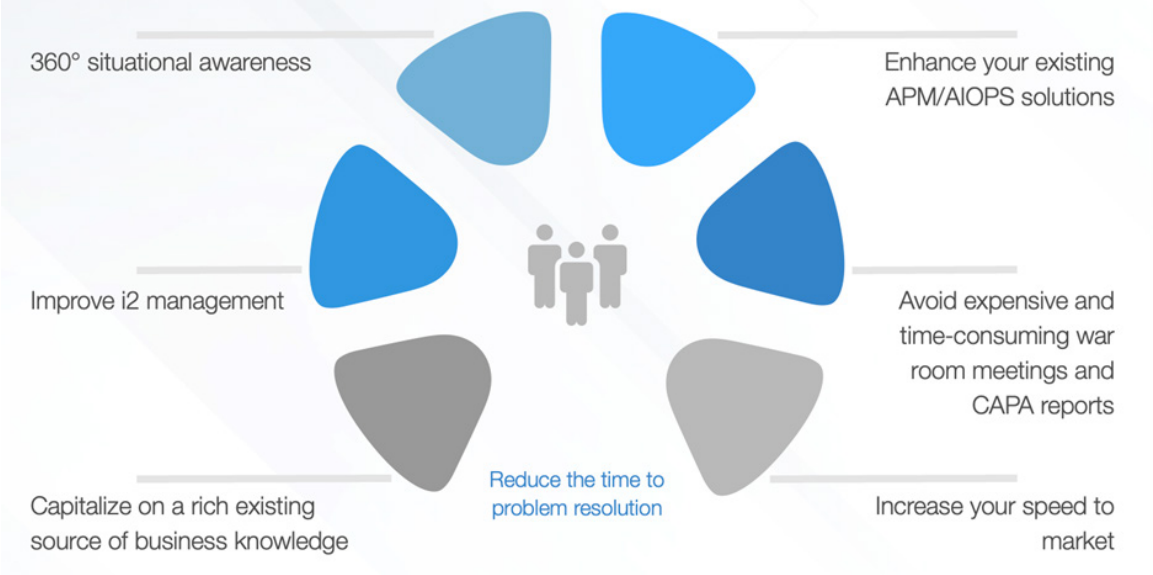


Figure 11- The Benefits of i2M

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