

Technology Audit

Integration and BPM

E2E Technologies E2E Bridge v3.6

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Abstract

E2E Technologies' product, the E2E Bridge, is an innovative solution for integration, based on the Object Management Group's (OMG) Model Driven Architecture (MDA) principles. Integration is a problem that is faced by most organisations today, which have numerous databases and applications that need to interact with one another, either to fulfil a business process or to provide a better understanding of disparate systems. The challenge historically has been that most tools that are aimed at the integration problem have been complex and expensive to deploy and maintain, with projects taking significant amounts of time and sometimes still not achieving the objective. Often, an integration product is acquired and then only used for a few key projects because of this complexity. What the E2E Bridge provides is an approach that uses a service-oriented concept to model the integration requirements, and then – very innovatively – executes the model directly. A concern is that this radical approach will be difficult to get across to potential customers, who may find it hard to understand and then believe how it can simplify the approach to integration. Organisations that are most likely to benefit from E2E's solution are those facing integration challenges that have some modelling expertise and the capability to work at a high level of abstraction; or that have already attempted complex integration projects and found them difficult to complete successfully. The optimal way to evaluate the solution is via a proof-of-concept project, and the company is willing to provide demonstrations of the product on request.

KEY FINDINGS

Key: ✓ Product Strength ✗ Product Weakness i Point of Information

✓	Using a visual UML tool as development front-end brings better collaboration between business and IT across the end-to-end integration process.	✓	The high degree of automation of the fully-model driven approach, allows integration projects to be completed in very short timescales and with high quality.
✓	Direct Model Execution means that the 'documentation is the code', with no discrepancy between the original design and operational version of the development artefact; hence documentation is always complete.	i	The product can be rapidly installed on a wide range of operating systems, with high transactional efficiency and low footprint. Runtime can be run on low-cost hardware.
i	The E2E Bridge is the first Enterprise Service Bus (ESB) in the form of a UML virtual machine, executing integration service models without ever generating code.	✗	Getting uptake of a relatively new concept using UML/MDA will be a challenge and requires rethinking of how business integration is carried out.

LOOK AHEAD

The Model Driven Architecture approach to application development has taken a number of years to evolve, and still lacks widespread adoption. However, a model-driven approach to integration may be much easier for organisations to understand and get real benefits from. E2E's offering is due to be updated to use the latest version of UML, version 2.0, later in 2006.

► FUNCTIONALITY

Product Analysis

Organisations of all shapes and sizes face a common set of problems with integration – the sheer complexity and the time it takes to actually integrate disparate applications. Once integration outside the organisation is required, this complexity compounds itself, and then there are considerations to be made about what toolset to use to achieve integration. Performance issues can arise, not least in that it is often necessary to add extra infrastructure to actually run integration procedures on. Combined, these often mean that integration projects often fail to deliver the results.

E2E addresses many of the complexity issues with an extremely innovative offering – the E2E Bridge. It is not very often that one comes across a radical new way of solving a complex problem, but E2E appears to have identified a very different approach to the complexity that surrounds integration; what it calls Model Driven Integration (MDI). The MDI approach enables organisations to specify, document, and then execute their integration services end-to-end (hence the company name E2E), with a product called the E2E Bridge. This uses the main concepts of Model Driven Architecture (MDA), although it does not follow all of the layers from MDA where a high-level platform independent model is developed, and then a platform specific model, usually in the form of Java or C++ code, is generated. The E2E approach differs in that the E2E Bridge itself can be regarded as a ‘virtual machine’ that interprets Unified Modeling Language (UML) models directly, and therefore the model is executed without needing to go through the additional step of generating code. A wide range of platforms can be used, and the server specification required is minimal; additionally the solution can comfortably co-exist with existing integration products, allowing reuse and complementing previous investments made in traditional Enterprise Application Integration (EAI) solutions.

This can be valuable to an organisation because it can significantly speed up integration projects. Whilst the product does require some minimal understanding of UML, this is becoming a much more widespread skill and certainly in much greater use than the skill sets required for many of the better-known integration tools, which tend to use proprietary modelling techniques. The savings in time claimed by a number of the company’s case studies indicate that using the E2E Bridge is proving a significant benefit to its customers, in terms of time saved, drastically reduced maintenance cost, and minimal hardware requirements for actually deploying integration processes and services.

Whilst executing UML is not unique, it is certainly still rare, and more often used within real-time embedded systems. However, using UML in an integration project is normally considered too detailed for business users, and of little value to developers because an integration tool (or code) is still then needed to actually carry out the integration. E2E’s method of developing an engine to execute a UML model directly is certainly innovative and allows extremely rapid and efficient integration.

Another differentiator with the E2E solution is that it uses an aspect-oriented approach to specify the various security procedures, compliance policies, and monitoring requirements in form of a model. These aspects are then managed by security specialists and are transparently used by all services built throughout the organisation, abstracting security away from developers.

This separation of concerns reduces the risk for security staff when changing security policies over time, because the enforcement of new policies is guaranteed and automatic, rather than having to go through a re-education of the service development teams, and no re-coding is required at the service level when policies change. Modelling and executing security policies as documented also simplifies audit procedures.

The E2E Bridge is a solution aimed firmly at application-to-application integration; it will need to be supplemented by other tools and methods where significant human interactions are required. Butler Group is also concerned that whilst the uptake of UML and MDA understanding is undoubtedly growing, the vast majority of developers are still keen to start coding, and it will take visionary management to encourage the adoption of techniques that can bring significant benefit. Use of such tools may be perceived as de-skilling the developer role, when the opposite is actually more likely.

E2E has developed an innovative solution to a problem that affects the vast majority of organisations. Butler Group believes that the model-driven approach will face some challenges but should be one that is considered by many organisations to get a better grip on their integration projects.

Product Operation

The process of integration is standardised using the E2E solution. It is broken down into a number of stages that are easily understood and repeatable. The first phase is to identify integration services, then to automatically extract the relevant legacy system metadata and services, perform semantic mapping and orchestration, and design any new services required from scratch. The resulting models are then compiled and executed, tested debugged as needed using an automatic UML trace tool that is included, and once live, the running services can then be monitored. All of the requirements for integration, as well as all the software artefacts that are then created, are defined in an executable UML model.

The diagram below provides an overview of the functionality that the E2E Bridge offers:

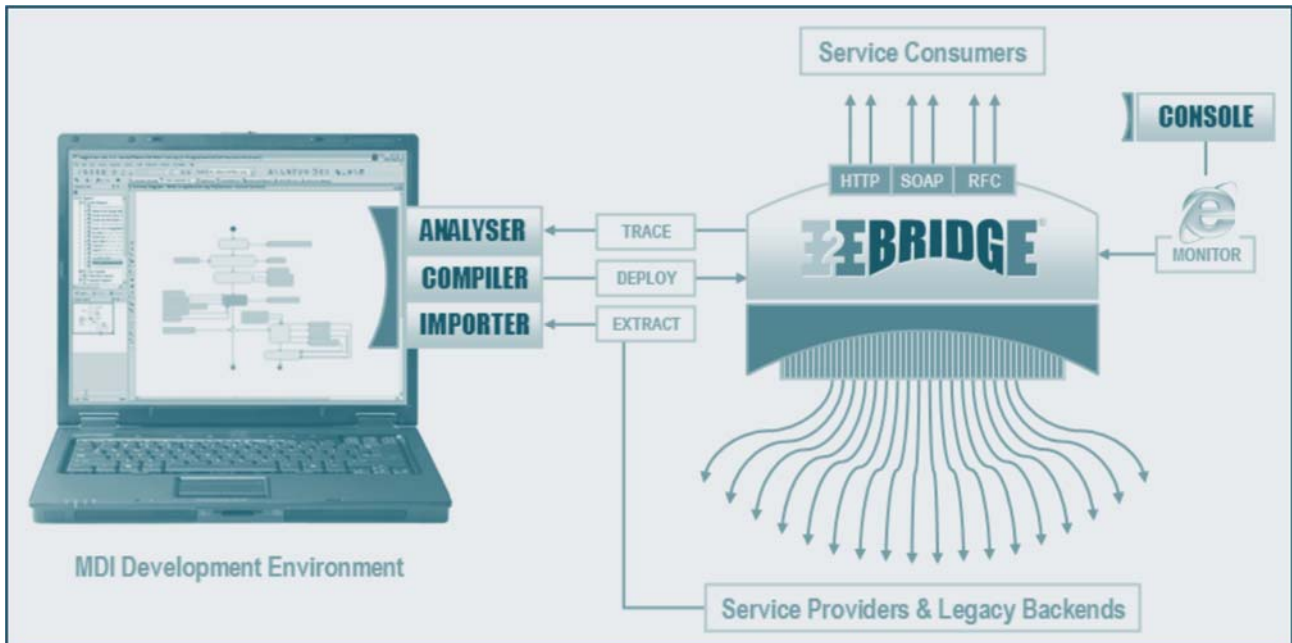


Figure 1 – Architectural Diagram of the E2E Bridge

The main concept used by the product is the idea of rapidly building re-usable integration models that can then be orchestrated to deliver high-level business services as required.

For development purposes, any XML Metadata Interchange (XMI) v1.0 compliant off-the-shelf UML editor can be used as the developer front-end, although E2E currently uses MagicDraw v9.5 from No Magic. The E2E tools are plug-ins to the UML editor, offering automated metadata import, model compiling, and model debugging. A carefully selected subset of UML diagrams are used within the design tool:

- Use Case Diagrams – used for modelling requirements, roles, services, systems, data, and security.
- Class Diagrams – used for the definition of semantic mappings and associated metadata.
- State and Activity Diagrams – used for the definition of service logic and orchestration of services.
- Deployment Diagrams – used for specification of the system landscape and physical service bindings.
- Sequence and Activity Diagrams – used for service debugging and profiling.

Within the development environment, once a model is created, the E2E plug-ins then validate, optimise, and finally deploy the UML integration model to the E2E Bridge, which is the actual runtime environment. This provides the functionality of an Enterprise Service Bus (ESB), including linking to adapters to the various back-end systems. While E2E provides a comprehensive selection of adapters that are pre-packaged with the E2E Bridge distribution, other packaged application adapters can be sourced from a standard adapter providers, such as iWay or NetManage. Additionally, the E2E Bridge provides transaction control, transaction monitoring, message transformation and routing, and security. The product allows the developer to use a standard 'project' environment. A model debugger is included that can automatically test and debug an integration project at the UML model level, using red/green colour coding to indicate where issues have arisen (see Figure 2).

Once deployed, the Web-based E2E Console is used to manage and monitor the integration services, including the monitoring of individual messages and transactions. In addition, the E2E Bridge can be integrated with standard systems management products, such as HP OpenView or Tivoli.

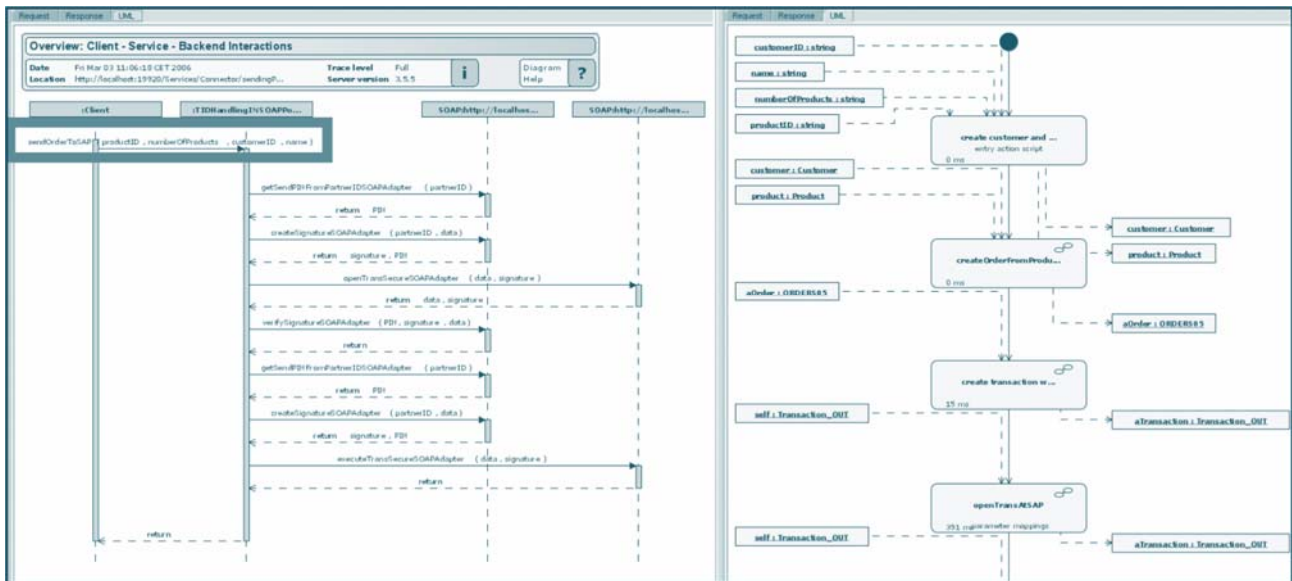


Figure 2 – Debugging Integration Services Using a Hierarchical UML Trace

Within the model debugger, there is also the facility to create a WSDL definition automatically for each designed service, allowing it to be used outside the solution. The E2E Bridge server can also deliver the actual WSDL of a service on demand, in which case no service registry is needed. One use for this is to manage a service within a higher-level Business Process Management (BPM) platform, such as IDS Scheer's ARIS product, and then use it within a BPEL-compliant process engine, such as the ones provided by Oracle or IBM. A first example of this kind of BPM integration was recently presented in the form of the new ARIS Bridge solution by IDS Scheer, which uses the E2E Bridge technology to bridge between process documentation and the existing IT assets by making processes executable using end-to-end modelling.

The runtime instances can be distributed across a network of servers to provide scalability and reliability.

Product Emphasis

The overall emphasis of the E2E Bridge is on modelling integration services in an iterative manner, allowing business and technical people to work together on an integration project, and to then execute the model, thereby avoiding any issues of generating and maintaining code. This latter point is where the longer term benefits of this approach are likely to lie. Because the model is all there is, it is very straightforward to then alter it directly over time to implement change requests. Often, it takes only a few minutes to modify an existing integration service based on business feedback, and then re-deploy it into production.

Comparing integration products is always complex, even where different software vendors use similar terminology. Butler Group would agree with E2E that the E2E Bridge provides much of the functionality that one would expect by the architectural style of an ESB, but uses a very different approach which does not require an application server. The challenge will be to gain still more widespread adoption of UML.

► DEPLOYMENT

The UML virtual machine built by E2E is a highly-optimised microkernel with an extremely small footprint. When combined with the necessary platform adapters, e.g. SAP, the total footprint of the solution is still only a few MB, and therefore the MDI runtime can fit on a wide range of servers, including older Pentium II and III based low cost PCs. The solution can be deployed on a range of operating systems including Windows, most common Linux distributions on x86 (SUSE, Debian, and RedHat), Sun Solaris, and IBM AIX.

One example that illustrates the small footprint required was an on-line transactional connection that integrated a legacy cash register application directly with SAP. The full integration server was installed onto a low cost PC with a Pentium III CPU, and handles failsafe transactional connections to the SAP back-end.

To design an integration service, an understanding of UML is needed, but according to recent studies on UML usage, business analysts feel quite comfortable with learning what is needed to develop and maintain UML models for the high level service definition, although more technical developers usually then extend the lower levels of the service model down to the specific back-end. The key here is that analysts and developers can share the same model context, rather than having separate specification and implementation models. Thus, the integration model becomes an effective communication tool.

Physical deployment of the product is rapid. The software takes less than half an hour to install, including basic functional testing. Projects can be designed and deployed within days, although a duration of a number of weeks is more typical for larger projects. E2E normally provides implementation services to assist with initial projects, but is also working with systems integrators to provide project implementation services. Most clients then learn the skills required to use the E2E Bridge on subsequent projects.

The solution is typically deployed on a project-by-project basis, starting with an area that has been problematic and then being used more widely. The speed of deployment on projects to date has been impressive.

As an integration product, the solution is naturally designed to integrate with existing applications. However, it is likely to be conceptually somewhat different from existing development and integration products, requiring some rethinking.

The E2E Bridge comes with a four-day self-training course giving an introduction to the basic concepts, the UML tool and the UML subset used to define integration models. An understanding of UML is beneficial but not required. Following this, a four-day best practice workshop is then recommended, to then model an end-user defined integration problem supervised by E2E. Additionally, the E2E Bridge documentation provides over 400 ready-to-use examples as executable UML models, providing a sound basis for reuse within a wide range of integration projects. E2E suggests that for a developer to become fully skilled requires some ten days training on the project, assuming a basic level of integration competency to start with.

The current version of the E2E Bridge comes bundled with MagicDraw from No Magic as the UML front-end editor. In addition, various adapters will require client libraries provided by the respective vendors, for example, SAP. Where required, a Java API can be used to build custom adapters such as for internally developed applications.

The overall objective of the MDI approach is to simplify the communication between business and IT stakeholders by using models as a shared communication context. This can be problematic if neither party is familiar with modelling concepts, but usually a visual approach clarifies requirements far better than using language that can be misunderstood, especially where the common language could well be a second language for the participants. In this respect, the MDI approach can significantly help to reconcile business and IT, and can therefore have a side effect of improving business and IT interactions.

Of course any project carries a degree of risk, and MDI projects are no different. If there is not a clear understanding of why the integration needs to be done, or there is not sufficient commitment to the project from management, there is a risk that an integration project will not succeed. However, the use of visual tools based on well-established standards such as UML, aims to improve communication between business and IT and hence minimise this risk.

► PRODUCT STRATEGY

The real value proposition of E2E is that it can provide rapid integration with a much lower cost of ownership than many of the integration solutions on the market, whether EAI or ESB offerings. The company claims that all of its projects to date have delivered improved integration by a factor of 10 to 20 times another method, mostly due to the rigorous uses of integration best practices and governance, but also due to the small footprint and high performance of the runtime engine, allowing hardware savings to be made. In a number of cases the product has delivered a successful outcome in an integration project that was previously failing.

E2E's marketing strategy is still under development. Its aim is to be a product company and therefore to sell the E2E Bridge either directly to user organisations or to systems integrators. The solution is suitable for a very broad market, although integration problems tend to be considerable in markets such as financial services, logistics, and telecommunications where market demands can require rapid integration between existing services in order to create new products. To date, E2E has developed some business partnerships to further this end, and of note, is the Technology Partnership with IDS Scheer, a highly respected player in the Business Process Management market. It is also a Global Software Partner for SAP, certified for SAP NetWeaver. Other technology partners include Microsoft (E2E is a Microsoft certified ISV), No Magic (which is just starting to resell the E2E Bridge worldwide), Adaptive, Hybris, BroadVision, X-Vision, CompuData, and Information Builders/iWay.

The company has already opened offices in key markets to enable it to support users in a wide range of global regions, and has developed a number of business partnerships including with Supply Chain Consulting, Trivadis, Bearing Point, Namics, Softlab, Unic, J&M, Aseantic, CompuData, Dixendris, BizPro International, and Uptime.

E2E has a separate pricing structure for the development and the runtime environment. The development environment is sold for EUR 25,000, which includes a perpetual licence plus support to partner and end-user organisations in a 5-seat bundle. All adapters and back-end extractors are included, as well as a development runtime for testing purposes, which cannot be used for production. For the production runtime environment, licence fees depend on a metric that E2E calls the "channel", or concurrently open connection in a time window of one second. A base configuration of five channels is the standard offering (at around EUR 100,000), which includes many adapters but not application-specific ones, such as for SAP. The company also offers transaction-based pricing.

Both hardware- and software-based licensing techniques are available. In the case of hardware-based licensing, the licence is delivered in the form of a dongle, which can be freely transferred from system to system. The company also offers recurrent licensing on a pay-as-you-go basis.

Maintenance and support is available at 20% of the licence fee per year, and covers next day business response, as well as telephone support during office hours. Enhanced support is available via partners and may be chargeable separately.

The short-term roadmap for further development of the product is likely to address the move from UML 1.5 to UML 2.0 before the end of the calendar year, which would still mean that it is one of the few products to support the most up-to-date standard. Although UML 1.5 covers all aspects required for MDI, the move to UML 2.0 has been triggered by E2E's use of off-the-shelf UML drawing tools as the developer front-end (MagicDraw already supports this).

The integration market is undoubtedly competitive. We have seen the recent emergence of the ESB concept as a threat to older EAI technology, and itself being threatened by the rise of open source offerings. E2E has sensibly stayed away from much of this concern, with its differentiated product, although it will still need to convince the developer community of the benefit of models, when code is far more familiar. There are some other executable UML offerings on the market (such as MentorGraphics BridgePoint UML Suite, and Kennedy Carter), but these do not have a strong focus on integration.

E2E has gathered an experienced management team to drive growth, and is actively working with a number of systems integrator partners to establish more widespread expertise in modelling with UML and using this for integration projects. Butler Group feels that this is a wise strategy, although the product will also be of interest to organisations that face integration challenges directly.

► COMPANY PROFILE

E2E was founded in 1996 by Alexander Büch and Serge Gansner, originally as an integration services company, with its major customer being UBS, which resulted from the merger between Swiss Bank Corporation and Union Bank of Switzerland. Having developed and used the concept of the E2E Bridge over the years, in October 2005 the company finally decided to concentrate on selling it as a software product. Privately-owned, E2E's headquarters are located in Basel, Switzerland, and it has additional offices in Dallas, Boston, London, and Sydney. The company has recently obtained venture capital funding to develop its international business and expand its reach globally. Today, the company is still relatively small, with some 30 employees most of whom are focused on product development and implementation support. E2E is a member of the Object Management Group.

As a privately-held company, financial data for E2E is not publicly available, but Butler Group has been reassured that the company has been profitable since inception and is growing in a sustainable manner. Although it could be regarded as a start-up, it has a strong management team, and already has 14 customers in total since its re-launch as a product-focused company in October 2005.

Key clients to date include:

- UBS, where the solution is used to assist with the integration of all retail business in Switzerland, and increasingly also international; up to seven million transactions per day are handled, with some 35 million requests to 40 different types of back-end systems. There are around 18,000 users involved and four million client accounts. Some 800 services have been modelled in UML, broken down into 160 business services with on average two version instances in production, plus approximately 500 technical support services and approximately 2000 back-end access services. All the transactions run on a 12 CPU Sun 4500 server (1GB memory per CPU) with four-fold redundancy.
- DKSH is the premier Services Group in Asia focusing on Sourcing, Marketing, Logistics, and Distribution. Founded and deeply rooted in Asia, DKSH successfully bridges complex markets within and between Asia Pacific, Europe, and the Americas. The company is using the E2E Bridge as its platform to integrate its principals, suppliers, and customers into a central SAP Template, which is the largest single SAP instance in Asia as well as the largest single SAP instance in the global supply chain industry. A project to integrate the company's Singapore IT operations with 15 services and 30 interfaces into SAP was achieved in 10 weeks by three developers. Further deployment of the E2E Bridge is underway to 15 countries within a two-year period.
- Swisscom is using the E2E Bridge for strategic integration of a .NET e-Commerce front-end with a J2EE back-end for its IP Television (IPTV) offering. The E2E Bridge reduced the integration of new services and products dramatically, allowing for a decoupling of business and technology innovation cycles.
- Agrano/Dr. Oetker, a European food business, set up secure online B2B connectivity to integrate the Agrano logistics with a central SAP system at Dr. Oetker, following an unsuccessful in-house integration project.
- Compudata uses the E2E Bridge as integration backbone for its B2Bnet solution, which provides SOX compliant payment services in a Software-as-a-Service (SaaS) model. Using the SOA design capabilities of the E2E Bridge, the development of the complete solution was achieved in three months, a fraction of the time that would have been required to develop B2Bnet using a classic integration approach. Based on the rapid integration capabilities of the E2E Bridge, Compudata reduced the time to integrate customer specific B2B connectivity by factors.

► SUMMARY

The E2E Bridge is undoubtedly a new approach to an old problem that goes beyond many of the visual integration mechanisms currently on the market (which can be superficially graphical but still require coding to join applications together); it does this by adding the element of executing the model without code. Butler Group would normally be concerned about the relative size of company in terms of its ability to scale, but its strong management team combined with a partnering approach to expansion, should mitigate these concerns.

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