

# zIIP-Enabling CICS® Integration Workloads

## HostBridge for zIIP

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A HostBridge® White Paper



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# zIIP-Enabling CICS® Integration Workloads

## HostBridge for zIIP

Over a span of six years beginning in 2000, IBM introduced three specialty engine processors – the Integrated Facility for Linux (IFL), the System z Application Assist Processor (zAAP), and the System z Integrated Information Processor (zIIP). IFLs are for z/Linux workloads and zAAPs for Java. zIIPs were originally for DB2, but many other workloads are now authorized, including products from licensed ISVs.

The value proposition of the specialty engines is clear and compelling. By shifting workloads from general purpose processors (GPs) to the less expensive and possibly faster specialty engines, IBM customers can expand their use of particular System z workloads, reduce processing costs, and lower total cost of ownership (TCO). Those using specialty engines may also be able to defer GP capacity upgrades, and those who use all of their GP capacity may experience significant performance improvements when switching workloads to the zIIP.

With HostBridge for zIIP, these benefits are now available to any organization that has a zIIP and that uses HostBridge® to run its CICS® integration workload.

## HostBridge, CICS, and zIIP

HostBridge for zIIP represents a breakthrough for any organization integrating CICS with other enterprise applications, SOAs, cloud architectures, or Web applications.

IBM CICS TS is the most powerful transaction processing system in the world. However, neither the CICS server nor traditional applications that customers write for CICS (COBOL, PL/I, etc.) are included among zIIP-eligible workloads. As a result, some IT professionals have operated under the assumption that a wall existed between CICS and zIIP – that they were antithetical or incompatible. HostBridge for zIIP proves this wrong.

With HostBridge for zIIP, organizations can now zIIP-enable 100% of their integration workload:

- The HostBridge Base Product (first introduced in 2000) can run 100% on the zIIP
- The HostBridge Process Automation Engine (our JavaScript engine for building Web services) can run 100% on the zIIP
- All HostBridge scripts/services that customers write are 100% zIIP-eligible.

As a result, many organizations using HostBridge to run CICS integration workloads will be able to shift all or nearly all of these workloads to the zIIP, thus reducing costs and improving performance. With HostBridge for zIIP, CICS and zIIP can now work together to generate savings from, and add new value to, application, SOA, cloud, and Web integration.

## zIIP Facts of Life

When HostBridge Technology began planning how best to exploit the zIIP for CICS integration, we had two clear objectives – zIIP-enable everything possible within the HostBridge product, and do so according to the rules established by IBM regarding zIIP deployment and workload eligibility.

When it introduced the zIIP, IBM established specific rules regarding what code can be executed on a zIIP:

- All zIIP-enabled workloads must run as an Enclave Service Request Block (SRB)
- While Enclave SRBs have many desirable characteristics (such as being pre-emptible), they still must adhere to the general rules that govern what SRBs can and cannot do
- As their name implies, Enclave SRBs run within a Workload Manager (WLM) Enclave; thus, they exploit WLM's enclave services. WLM enclave services, however, do not play well with other WLM services, such as WLM execution delay services (which CICS happens to use).

Structuring your code to execute as an Enclave SRB is necessary, but not sufficient. In order for the Enclave SRB to actually be dispatched on the zIIP, an ISV must use an IBM licensed interface to indicate that the Enclave SRB is zIIP-eligible.

This reflects the fact that IBM determines which workloads can be run on a zIIP. In the beginning, the zIIP specialty engine supported only DB2 workloads, but more workloads were soon added to the eligible list, including z/OS XML System Services, Global Mirror, Communications Server, and CIM Server workloads. Lastly, IBM gave ISVs the green light to zIIP-enable their workloads, opening the door to HostBridge for zIIP and the zIIP-enablement of CICS integration workloads.

IBM has licensed HostBridge Technology to zIIP-enable its integration products.

## CICS Realities

Of course, we faced other considerations in addition to the zIIP facts of life. As the CICS integration specialist, we were well aware that the unique characteristics of CICS itself would play a fundamental role in the solution we envisioned.

CICS is a “melting pot” of applications, data, services, etc.<sup>1</sup> This breadth of capability is one of the things that has made CICS so successful over the decades. It also adds a layer of complexity to zIIP-enabling CICS integration workloads and doing it well.

From a zIIP-enablement perspective, CICS applications are both the best-case scenario and the worst-case scenario. CICS has a very specific approach to separating application logic from CICS services; this turns out to be a good thing. Furthermore, CICS offers a growing degree of runtime freedom, e.g., with open TCBs and the

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<sup>1</sup> A HostBridge customer that we sometimes mention to illustrate this point, a major auto manufacturer, runs 3270 BMS, 3270 non-BMS, COMMAREA, Natural, and APPC applications that variously access DB2, VSAM, and Adabas data systems.

OPENAPI. But many of the basic rules that have governed CICS applications since the beginning are still in place (e.g., all EXEC CICS commands must be executed under a CICS-managed TCB). Furthermore, CICS establishes its own relationship to WLM, and it would not be wise to interfere with it.

Long story short, CICS has its own characteristics and behavioral rules – a great many in fact – and in the aggregate they make CICS integration workloads very unique (and zIIP-enabling them even more so).

## HostBridge

zIIP facts of life, CICS realities – what else could possibly add to the context of zIIP-enabling CICS integration workloads? The answer wasn't far to seek; it was HostBridge itself.

We at HostBridge are known for high-performance, high-fidelity CICS integration, and our products are designed very specifically for the System z and CICS environments. By design, HostBridge components are written in multiple languages (IBM Assembler, IBM XL C/C++, IBM Enterprise COBOL), and they traditionally run under CICS.

So all of these factors – zIIP, CICS, and HostBridge – boiled down to one question. How do we zIIP-enable a product that runs under CICS, that compiles with IBM LE compilers, that accommodates the realities of CICS, and that complies with the rules of the IBM zIIP license – and do so without sacrificing our hallmark performance or fidelity?

The answer is found in our design and architecture – which we will explain next.

However, to explain how we zIIP-enabled HostBridge, we need to define a few terms that describe how our software components run in relation to CICS:

- “Under CICS” – code that runs inside a CICS address space and under a CICS-managed SRB
- “Inside CICS” – code that runs inside a CICS address space but not under a CICS-managed SRB
- “Outside CICS” – code that run in a private address space within System z.

We employed all three of these approaches in zIIP-enabling HostBridge.

## HostBridge Architecture

Our passion is CICS and System z integration.<sup>2</sup> Since the founding of HostBridge, our singular goal has been to design, develop, and deliver the highest performance, highest

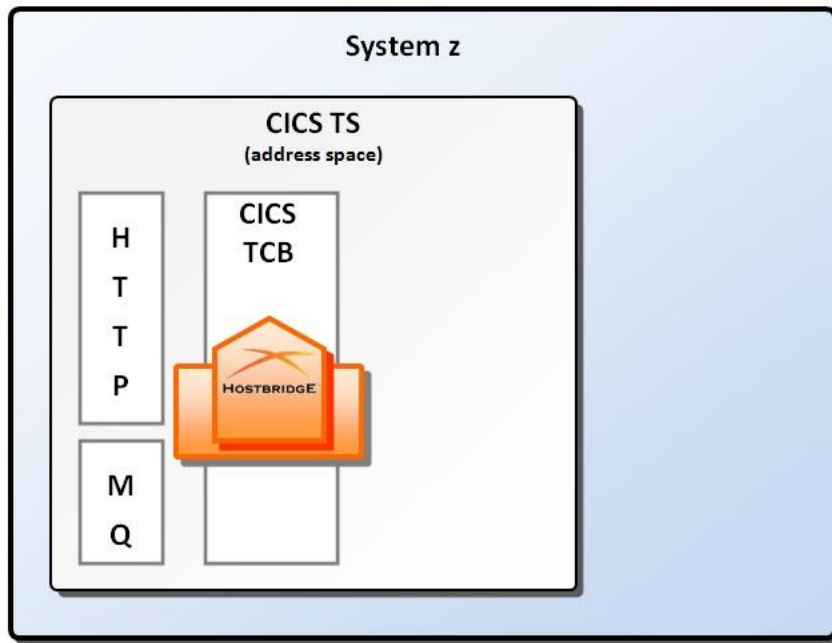
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<sup>2</sup> HostBridge literally wrote the book on integrating terminal-oriented applications. Read *Composing CICS® Services: A HostBridge White Book*, by HostBridge CEO Russ Teubner, to learn the why, what, where, and how of orchestrating and integrating CICS visual transactions. You can find an introduction to these concepts in our white paper, *Modernizing CICS® and System z*

fidelity mainframe integration software in the industry. To reach this goal with every component we introduce, we follow three guiding principles at all times:

- Exploit the very best tools and technologies that System z has to offer – including the zIIP<sup>3</sup>
- Adhere to the latest and best interoperability standards, including XML, SOAP, REST, and JavaScript
- Keep pace with evolving trends in enterprise computing and user interfaces.

The diagram below, simplified to focus solely on issues relevant to zIIP-enablement, shows how HostBridge has always worked (and will continue to work for customers opting to run their workloads on the GP).



**Figure 1. HostBridge Architecture (Workloads Processed on the GP)**

Since our product's first release, HostBridge has always run within the CICS address space and under a CICS-managed TCB. Thus, this style of execution would be described as "under CICS."

The fact that HostBridge runs under CICS is what allows it to deliver the highest combination of performance and functionality. By leveraging the Link3270 Bridge Interface, HostBridge intercepts CICS application output before the final presentation services are applied (before it becomes a 3270 data stream). HostBridge utilizes screen and field names as metadata and auto-converts the data to integration-ready XML. The HostBridge Process Automation Engine offers an added performance advantage by orchestrating and automating even the most complex CICS transaction micro flows into

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*with Web Services/SOA: The HostBridge Approach.* Both are available at [www.hostbridge.com/index.php/library/whitepapers](http://www.hostbridge.com/index.php/library/whitepapers).

<sup>3</sup> HostBridge is an Advanced IBM Business Partner, certified in the Ready for Rational and Ready for SOA programs, and a CICS Beta Partner, participating in beta cycles from CICS TS V3.1 through CICS TS V4.2 and counting.

a single, reusable Web service. Business processes that once required many request/response cycles through the network are now completed in a single exchange.

Of course, HostBridge was developed before the days of zIIP, and running under a CICS TCB means that it is not zIIP-eligible.

So we set out with a clear new mission – update the HostBridge architecture (under the covers) to zIIP-enable CICS integration workloads without sacrificing any functionality or performance.

## The HostBridge for zIIP Architecture

All the factors outlined above – zIIP facts of life, CICS realities, HostBridge itself, and their many combinations and permutations – together guided the design of HostBridge for zIIP. Constant in our commitment to performance, functionality, and integration fidelity, we set out to fashion an architecture that would allow us to abide by the rules and zIIP-enable CICS integration workloads optimally. Only in this way, we believe, do we maximize customer returns on their investment in System z, CICS, zIIP, and HostBridge.

Illustrated in the diagram below, the HostBridge for zIIP architecture ensures the zIIP-eligibility of 100% of HostBridge processing and 100% of scripts/Web services written with HostBridge.

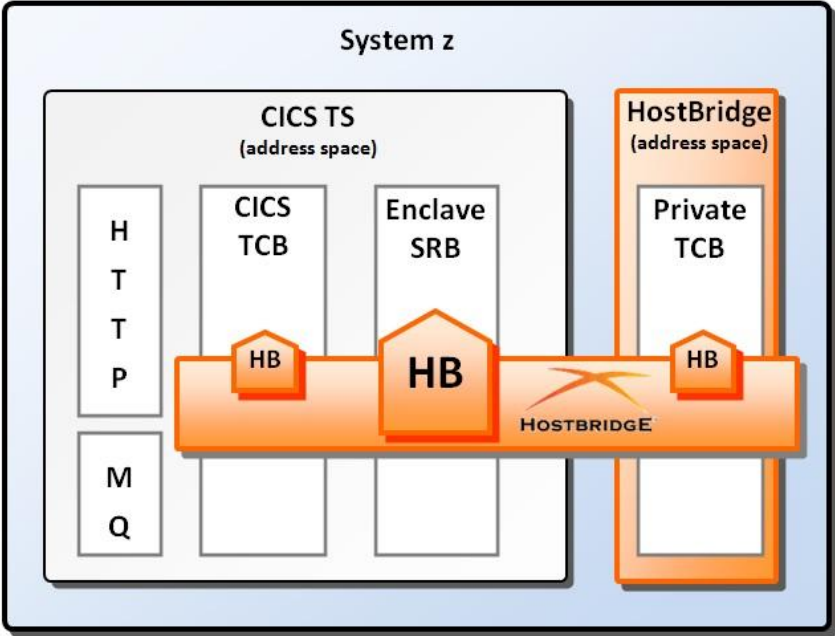


Figure 2. HostBridge for zIIP Architecture (Workloads Processed on the zIIP)

Since bulk of the HostBridge work is still performed inside the CICS address space, but not under a CICS TCB, we usually refer to this as an example of running “inside CICS.” However, the diagram illustrates that we have created a division of labor involving certain components running “under,” “inside,” and “outside” CICS.

## HostBridge Private Address Space

HostBridge for zIIP utilizes a private address space under System z and outside of CICS. As represented by the smaller HB pentagon at the right, a relatively small amount of work occurs outside of CICS. Yet this division of labor is absolutely essential in providing required functionality, control, and auditability. It also lets HostBridge overcome some of the limitations of the CICS environment.

## HostBridge Inside CICS (Enclave SRB)

The bulk of HostBridge for zIIP processing – represented by the larger HB pentagon – runs under an Enclave SRB inside the CICS address space. As such, we say this part runs “inside CICS” but not “under CICS” (i.e., a TCB managed by CICS). This unique architecture allows HostBridge for zIIP to retain all the functional advantages of running inside the CICS address space, while also fashioning the workload so it can execute on the zIIP. This architecture also allows 100% of the HostBridge Base product and Process Automation engine to run on the zIIP – including all customer written integration scripts and Web services.

## HostBridge Under CICS

A portion of the HostBridge work continues to run under CICS – i.e., under a CICS Open TCB. The work processed under the CICS TCB falls into a few categories:

- The initialization and termination logic required to process a HostBridge service request
- All EXEC CICS commands – whether issued by HostBridge for its own benefit (e.g., reading a VSAM file to obtain the script/service) or issued by a customer written script/service
- All existing CICS transactions or programs that the integration script/service causes to be executed (the customer-written integration script/service runs on the zIIP, but not the traditional CICS transactions/programs it orchestrates).

In summary, the HostBridge for zIIP architecture has been designed to adhere to all the various rules and constraints for zIIP-enablement without sacrificing any of the functionality that customers expect of a world-class integration platform.

Whatever type of integration your organization performs or envisions – integrating CICS with other enterprise applications, bringing the mainframe into an enterprise SOA, moving CICS applications or System z data to the cloud, or Web-enabling CICS apps for browser access by employees, partners, or millions of online customers – all of your integration workloads can be zIIP-eligible with HostBridge for zIIP.

## zIIP Benefits and Integration Workloads

When user-organizations zIIP-enable CICS integration workloads, they gain two primary benefits – lower processing costs and improved performance. Doing so with HostBridge for zIIP executing integration workloads inside of CICS, they nearly always multiply these benefits.



The level of benefit that HostBridge for zIIP and the zIIP specialty engine provide will depend on an organization's particular situation – from the volume of its integration workload and the complexity of its integration scripts/Web services to its utilization of both the GP and zIIP processors.

The two customer scenarios that follow serve to illustrate the range of benefits that can be gained by zIIP-enabling CICS integration workloads with HostBridge for zIIP.

## **1. Cost Reduction at a Financial Institution**

A financial institution with five million customers worldwide runs its business on a suite of CICS-based banking applications. While its GPs do not run at full capacity, the institution is interested in reducing its System z cost of ownership by shifting workloads to specialty engines. Its existing System z hardware has a zIIP installed but not utilized heavily. The institution deploys HostBridge for zIIP to shift a significant part of its CICS integration workload from its GPs to the zIIP.

Imagine an account holder stopping at an ATM to withdraw cash. When she logs in at the ATM, the first display she sees is her accounts overview with basic information about her accounts and balances – savings, checking, credit card, etc. Behind the scenes, the ATM caused a Web service request to be sent to HostBridge to execute a Web service – the “Get Account Overview” service. This HostBridge script/service orchestrates the execution of several CICS COMMAREA programs to get customer data, get savings balance, get checking balance, etc. HostBridge takes the COMMAREA program output from each of these operations and aggregates it into a single Web service response. All of this happens within a fraction of a second and the data is displayed at the ATM.

The response-time benefit that HostBridge delivers (because it orchestrates the execution of multiple COMMAREA programs from inside CICS, not from the middle tier) remains the same when HostBridge is running on the zIIP. However, the cost savings that accrue when all HostBridge services are run on the zIIP are substantial. This is because the aggregate transaction volume from five million account holders is so large.

Shifting the processing of Web services and integration for millions of transactions to the zIIP creates substantial savings for the financial institution. And by lowering its processing costs (per transaction or aggregated), the customer can afford to promote access to its services through many different channels (Internet, iPhone, etc.).

## **2. Performance Improvements at a Department of Education**

The Department of Education in one of the largest cities in the U.S. uses CICS-based applications to perform financial accounting. Their System z GPs run at 100% during peak processing times – and processing demand continues to grow. During these peak periods, response time suffers for all workloads, and business units battle over limited processing resources. They have a zIIP, but it is scarcely utilized. Additionally, on their System z model the zIIP runs 20% faster than their GPs.

One of the impacted activities is their CICS/HostBridge integration workload. Their particular environment uses Microsoft BizTalk Server to exchange HTTP/XML requests and responses with the HostBridge Base product. This allows BizTalk applications to interact with the data and program logic supported by the CICS financial transactions.

After installing HostBridge for zIIP, the department saw response times for HostBridge requests improve dramatically. This is because the HostBridge integration workload was moved from processors that were already fully utilized (the GPs) to a processor that was relatively idle – and faster. Furthermore, by reducing overall demand on the GPs, the department experienced incremental performance improvements for all other System z activities. Thus, by zIIP-enabling just its CICS integration workload, the department improved System z availability and performance for all users.

## One HostBridge, Multiple Options

To be clear, HostBridge for zIIP *is* HostBridge – the same integration software, the same code base, the same functionality. The only difference is that HostBridge for zIIP adds the specific set of technologies that allow it to run according to the zIIP rules. In this way, HostBridge for zIIP delivers all the functionality, performance, and fidelity of HostBridge plus the benefits of the zIIP specialty engine – savings on processing costs, lower mainframe TCO, and higher performance – often dramatically higher.

There may be situations in which user-organizations would opt not to shift their integration workloads to the zIIP. In such cases, they can make use of our “traditional” configuration – the HostBridge Base Product’s XML automation or the scripting/Web services of the HostBridge Process Automation Engine (or both) – executing entirely under the CICS TCB.

More often, there will be situations in which organizations choose HostBridge for zIIP – including the full complement of HostBridge integration technologies – in order to gain the cost savings, lower TCO, and improved performance of the zIIP specialty engine together with the performance and fidelity of HostBridge.

With HostBridge and HostBridge for zIIP, you have choices. We encourage you to consider them carefully in light of your unique situations and workloads.