



Whitepaper

SOLA

Incorporating Mainframe Systems in Service-Oriented Architecture

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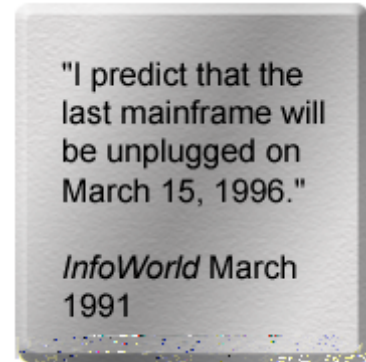
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1. The Mainframe Lives

To paraphrase Mark Twain, "*The rumors of the death of the mainframe have been greatly exaggerated.*" Despite numerous forecasts to the contrary, the mainframe has been quietly consolidating its position as the premier enterprise-computing platform. Year after year, IBM has reported significant growth in mainframe sales while the world's largest companies continue to rely on the mainframe to be the backbone of their business processing.

CICS is the premier teleprocessing monitor on the mainframe. Globally, CICS processes an average of 30 billion transactions per day totaling over \$1 trillion – that's more transactions than the entire internet. CICS is used by 490 of the Fortune 500 firms as well as thousands of smaller companies. More than thirty million people in over 90 countries use CICS applications. An estimated 300,000 programmers develop CICS applications and more than 50,000 CICS licenses have been sold. IBM and thousands of software companies support CICS packages on multiple platforms.

The challenge facing corporate IT departments today is leveraging these mission critical applications as they develop new composite applications. SOLA is the solution to this problem. By allowing host applications to participate in Web Services, the IT department can focus its energies on the assembly of composite Web applications. Through SOLA, cost and time effective integration is finally possible.



2. The Problem Space

Many Corporate IT organizations are struggling to satisfy the shifting demands of a constantly evolving business environment. In particular their problems include:

- Keeping the business stable
- Lowering costs
- Rapidly responding to changing market conditions
- Modernizing the application portfolio

These problems are particularly acute when maintaining host CICS applications; it's a well known rule of thumb that companies devote 70 to 80% of their IT budgets to the maintenance and enhancement of these applications.

With the move to Web based applications, the mainframe world was left isolated in a "closed" environment, leading to significant challenges for companies struggling to expose their mainframe applications to the Web.

Thanks to SOLA's extension of Service Oriented Architecture to the mainframe platform, the mainframe can finally participate in this revolutionary advance.

3. SOLA - A Single Comprehensive Solution

SOLA is a unique standards based single solution that bridges the gap between mainframe applications and the distributed world, thereby leveraging decades of investment in existing applications. SOLA provides proven, quick, efficient and cost effective application integration by publishing legacy applications as Web Services. This is accomplished without any additional hardware, middleware, software, coding or cross platform skills training. SOLA's powerful toolset -- and Web Services -- dramatically reduce application development cost and time to market.

Service Oriented Architectures can only achieve the promise of improved ROI in the enterprise by integrating mainframe applications. Migrating mainframe applications and/or data to a distributed platform is costly and unrealistic, so developers need the ability to expose those applications as reusable mainframe services.

3.1. SOLA Features and Advantages

SOLA has several significant advantages over competitive products. Taken together these features provide lower cost and greater productivity. The features are:

- **Services created from the “Inside Out”**
All competitive products create services from existing mainframe programs, but only SOLA creates services from the “inside out”. With SOLA the mainframe programmer – the person who knows the program the best – creates the services. Competitive approaches expect the distributed programmer – the person who knows the program the least, if at all, to create services from the “outside in”.
- **Brower based development environment**
With SOLA there's no workstation software to install – the entire SOLA development toolset runs in a browser. This is a huge advantage – in our experience the majority of developers don't have workstations that are powerful enough to run the “previous generation” development toolsets provided by competitors.
- **UDDI Directory**
All services created by SOLA are automatically documented in the SOLA UDDI directory. With competitive products services are created and documented in the developer's local workstation's workspace, making it difficult to discover and reuse them in other applications.
- **Standards Based**
SOLA is a standards based solution, allowing interoperability across platforms, operating systems and programming languages. Being

It is estimated that 90% of any given project is spent developing “plumbing code.” SOLA eliminates this problem, leaving application developers to focus on solving business problems.

standards based also allows SOLA to expand and evolve without cumbersome enterprise-wide revisions, giving it unparalleled reusability and growth potential.

3.2. Advantages

- Proven and Enterprise ready
- Easy to use and deploy
- Solves today's most pressing problem – integrating new applications with mainframe legacy applications
- Publishes legacy applications as Web Services, allowing them to easily integrate with .Net, J2EE or any other development environment
- Provides highly efficient, simple, reliable and secure integration of legacy code and data
- Supports both http and MQ transport layers
- Inbound and outbound web services support (the mainframe can act as a web services server or a web services client)
- Eliminates the need for cross platform skills training (no Java or Visual Basic skills are required to publish Web Services from legacy applications using SOLA)
- Includes comprehensive documentation



3.3. SOLA – SOA's Single Solution

SOLA is a a single solution that can replace all other host integration products, realizing significant savings:

- **Reduces the number of middle tier servers**
SOLA requires no middle tier servers, thereby lowering TCO, improving performance and reliability and eliminating points of failure.
- **Reduce development costs**
Up to 80% per each \$1 million of development project spending can be saved.
- **Lower the cost of ownership**
With SOLA there is no need for expensive middleware and gateways.
- **Improve reliability**
SOLA is scalable, robust, and has a proven track record.
- **Dramatically increase performance**
By eliminating middle tier servers the major performance bottleneck in most applications is eliminated.
- **Modernize host applications without re-coding**
Host applications are already running most businesses. SOLA allows them to continue running unmodified while providing new ways to leverage them.

4. What is SOLA?

SOLA is an interface to CICS applications. It allows CICS applications to participate in Web Services by accepting SOAP requests from the Web and converting them into formats expected by the CICS applications, executing those applications and then converting the results into SOAP responses. Additionally SOLA provides an effortless way for the mainframe programmer to execute external web services.

SOLA has three major components:

- The SOLA Development Environment
- The SOLA Run-Time
- The SOLA Directory

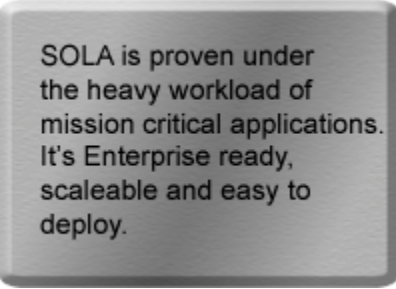
4.1. The SOLA Development Environment

The SOLA Development Environment is a comprehensive server based toolset consisting of all the tools necessary to create and manage Web Services from CICS applications. Included in the SOLA Development Environment are the SOLA Analyzers, the SOLA Directory, the SOLA Testing Facilities, Monitoring, Error Tracking and Tracing tools, and SOLA Administration. No special software is required on the user's workstation to use the SOLA Development Environment – it is completely browser based.

5. The Benefits of SOLA

5.1. Leverage Prior Investment

Most large companies run the vast majority of their core business on mainframes. For many, the investment in their mainframe systems is considerable. By using SOLA, companies can rapidly leverage prior investment, allowing quick modernization of business infrastructure while maintaining the stability of the production environment. By modernizing the interfaces to applications while leaving the applications intact, companies can realize significant cost savings by reusing existing resources – all while eliminating the risks associated with redeveloping applications.



SOLA is proven under the heavy workload of mission critical applications. It's Enterprise ready, scaleable and easy to deploy.

5.2. Mainframe Highly Scaleable

SOLA leverages the unmatched scalability, performance and reliability of the mainframe platform. Because mainframe systems are often connected using a parallel sysplex, SOLA takes advantage of the fail-over capabilities of the zSeries hardware and the workload management features of the z/OS operating system.

5.3. No Middle Tier Hardware or Software

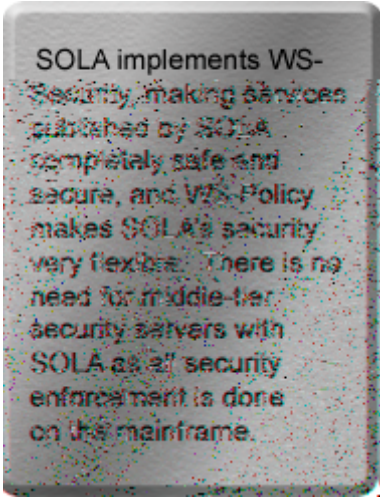
This greatly reduces TCO, improves performance and reliability and eliminates points of failure.

5.4. No Cross Platform Skills or Training

Using SOLA, a mainframe COBOL developer can quickly and easily publish an application as a Web Service without any knowledge of Java, Web Services or even XML. SOLA's user friendly interface is easy to learn.

5.5. Security

SOLA implements security based on the WS-Security standards, such as XML Encryption, XML Signature, User Name token, X.509 and SAML. SOLA also supports http basic auth, https (SSL) and IP Channel lockdown. Additional standards, such as WSDM and BPEL4WS are planned for future releases. Because security rules are defined using WS-Policy, the security administration and implementation is very flexible.



SOLA implements WS-Security, making services published by SOLA completely safe and secure, and WS-Policy makes SOLA's security very flexible. There is no need for middle-tier security servers with SOLA as all security enforcement is done on the mainframe.

5.6. Standards

SOLA is a standards based solution, allowing SOLA to expand and evolve without cumbersome enterprise-wide revisions, giving it unparalleled

reusability and potential to grow.

5.7. Reuse

SOLA promotes reuse. Previously the business logic encapsulated in most legacy programs was known only to the program development group and the applications areas using the program. Once exposed as a Web Service, the functionality is documented in the SOLA directory and becomes widely accessible.

5.8. Simple Testing and Debugging

An integrated test harness means that the developer can easily test a Web Service with the simple push of a button.

5.9. Comprehensive Monitoring, Error Logging and Tracing

This has proven invaluable for quick problem resolution.

5.10. Multiple Transport Protocols

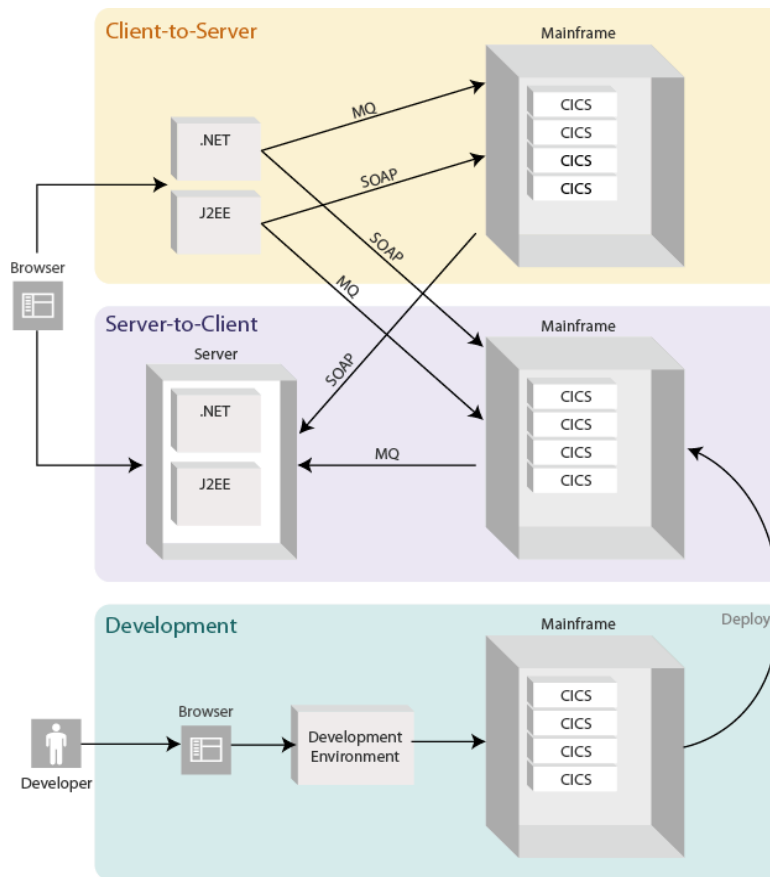
SOLA supports http, https (SSL) and MQ transport protocols.

5.11. Administration Tools

SOLA has built in Administration tools that allow the user to manage individual web services.

6. SOLA Run-Time Architecture

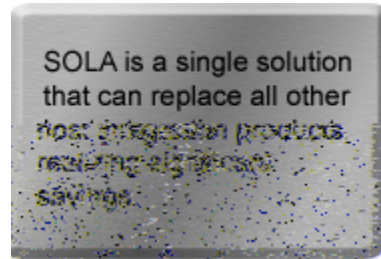
SOLA was designed to exploit the Web Support features of CICS TS 1.3 and later. SOLA provides data over two transports – http/s and MQ. With http, SOLA uses the CICS Web Support features to listen on a TCP/IP port. When a request is posted to the port, CICS dispatches SOLA to process the request. The SOLA common driver program then parses the SOAP request and calls the appropriate plug-in to process it.



7. SOLA Interface Plug-Ins


SOLA offers a plug-in to correspond to each of the interfaces exposed by CICS programs. SOLA provides the following interface plug-ins:

- COMMAREA
- 3270 Aggregated Transaction
- Web Services Client
- DB2 Stored Procedure
- Dynamic SQL
- Document Object Model API
- VSAM
- ODBC as XML API



8. SOLA Development Environment

The SOLA Development Environment uses a J2EE compliant server and requires no workstation software to be implemented. The full features of the development environment are accessible through a browser.



The SOLA Development Environment is a comprehensive toolset containing all of the tools necessary to create and manage Web Services from CICS applications.

8.1. SOLA COMMAREA Analyzer

The SOLA COMMAREA Analyzer is used to analyze programs that expose a communications area interface. The analyzer reads a program's compile listing, parses the COMMAREA and determines how the fields within the COMMAREA are used. It then produces a WSDL file documenting the interface, a test harness and a run-time metadata template. The template can be moved to production using standard change management procedures. The program will be automatically documented in the SOLA directory.

8.2. SOLA 3270 Analyzer

The SOLA 3270 Analyzer implements an interactive interface. Using this tool, developers execute the application by going through the application's screens/maps. SOLA automatically records the interactions and aggregates them into a single web service (for example, a multi-screen update transaction will be published as a single web service). It then produces a WSDL file documenting the interface, a test harness and a run-time metadata template. The template can be moved to production using standard change management procedures. The aggregated transaction is automatically documented in the SOLA directory.

8.3. SOLA Outbound Analyzer

The SOLA Outbound Analyzer allows developers to "import" the WSDL representing an external web service and then "analyze" the operations of that service to create callable methods. The analysis automatically creates COBOL copybooks that represent the interface to the operations. This approach allows COBOL programmer to execute an external Web Service with a simple "CICS Link" command.

8.4. The SOLA UDDI Directory

The SOLA UDDI Directory is maintained in DB2. All Web Services created by SOLA are fully documented in the SOLA Directory and are organized by project. Since it is a UDDI directory, it is searchable in a variety of ways.

8.5. The SOLA Testing Facilities

SOLA automatically creates a test harness for every Web Service created. This is an extremely helpful tool for the Web Service creator (usually a COBOL

programmer), as it allows for the testing of new Web Services before deployment.

9. SOLA Run-Time Environment

9.1. MRO

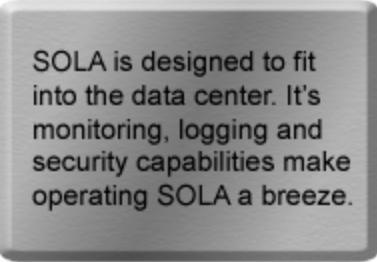
SOLA can run using standard CICS multiple region operation (MRO). The http/MQ listener runs in a listening region, dispatching the host application programs in application owning regions. SOLA handles the communication of data between the listening and application regions. Although CICS has a limit of 32K that can be passed between the listener and application regions, SOLA can accept requests and deliver responses that exceed this limit.

9.2. Error Logging

SOLA provides full error logging. Error logging reports are available through a Web reporting tool and are also provided as a Web Service.

9.3. Monitoring

SOLA monitors every transaction that it handles. Monitor reports are available through a Web reporting tool and are also provided as a Web Service.



SOLA is designed to fit into the data center. It's monitoring, logging and security capabilities make operating SOLA a breeze.

9.4. Tracing

SOLA provides an optional tracing facility, which records both input and output SOAP messages for traced transactions. The facility is extremely useful for problem diagnosis.

9.5. Security

SOLA implements a standards based security solution. Security definitions in SOLA are based on the WS-Security standards, and are implemented using WS-Security-Policy and X-KMS. SOLA implements XML Encryption, XML Signature, User Name token, X.509 and SAML, and supports http basic auth, https (SSL) and IP Channel lockdown. Additional standards, such as WSDM and BPEL4WS are planned for future releases.

9.6. Transport Mechanism

SOLA offers http/s and MQ as transports.

9.7. Outbound SOAP requests

SOLA provides the ability for the CICS programmer to issue an outbound SOAP request to an external system. That SOAP request is transported by http, https (SSL) or MQ to the external system.

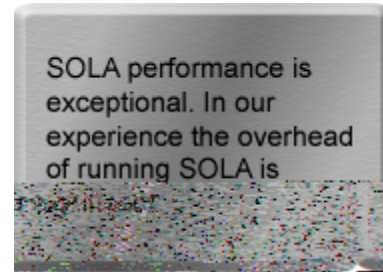
9.8. Configuration

SOLA takes advantage of the full scalability and fail-over features of parallel sysplex. SOLA introduces no affinities, allowing the workload manager to run transactions on any system in the sysplex.

10. SOLA Performance

10.1. Throughput

IP Port sharing, Workload Manager and an MRO configuration create a highly scalable SOLA environment, with no performance degradation as throughput increases. SOLA scales by adding additional listener regions.



10.2. Stability

Millions of transactions have been processed through SOLA during extensive stability tests. No failures were experienced. SOLA has been in production for two years – no production failures have been experienced. To date, well over a billion transactions have been processed by SOLA.

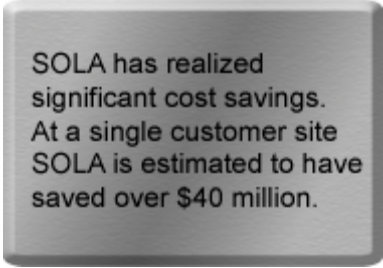
10.3. SOLA Parser Performance

SOLA includes a compliant non-validating parser (the SOLA DOM parser). Extensive performance tests were conducted to estimate the impact of parsing XML on a mainframe. The results were as follows:

- The SOLA parser takes around 0.0001 CPU seconds to parse 1,000 bytes.
- Parsing 1,000 bytes (a typical input XML message size) adds less than 1% to most transactions.
- At a typical chargeback rate of \$0.20 per CPU second, parsing 1,000 bytes would cost \$0.000020. That amounts to a minuscule \$20 to parse 1 million transactions.

11. SOLA Cost Savings

SOLA is proving its worth in production every day in one of the most demanding industries in the world – the financial services industry. There are currently over 40 SOLA applications in production. Clients estimate that SOLA saved each application \$0.5 to \$2 million through cost avoidance and direct savings.



SOLA has realized significant cost savings. At a single customer site SOLA is estimated to have saved over \$40 million.

“We had estimated about \$800K using traditional technology to build a system. But by embracing SOLA we did the project for \$30K.” CTO, Major Wall St Firm.

“SOLA gives us a competitive advantage by allowing us to bring products to market quicker than our competitors.” Andy Brown, Chief Technology Architect, Merrill Lynch.

12. SOLA Customer Testimonials – Merrill Lynch

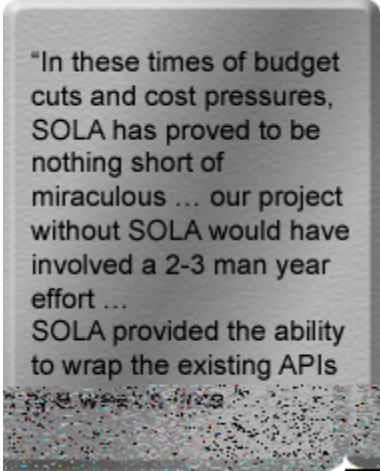
12.1. Retirement Management Organization

“We are using SOLA to move the "Retirement Group 401k Compliance" processing to a web-based model with SOLA acting as a service provider. This enables us to provide an internal web based solution that is easily extended to the public web for our clients. In addition, we get to use the same backend CICS COBOL code base without changes to the business logic. Being CICS, the application is scaleable, efficient, and reliable. It also provides us with some flexibility packaging mainframe report data into XML so we use XSLT to format HTML or PDF or etc.... from the same document.”

12.2. Securities Custody Organization

“SOLA is a critical piece of technology that will continue to be embraced by our company. By using SOLA we were able to quickly and cost-effectively integrate back-end Host functionality with distributed applications in a flexible and extensible manner.

We have vast capabilities invested in Host based transactions and in today's environment such transactions need to be interfaced to Web/Portal applications, distributed transactional processors and internal/external B2B integrations. Consequently we have a large number of Host based data links and connectivities that are brittle, inflexible and difficult to maintain. SOLA has the capability to be a quick, easy and extensible mechanism for Host transaction integration. And as we move towards leveraging web services technology, SOLA is the center-piece of our Host integration tool-set.”



“In these times of budget cuts and cost pressures, SOLA has proved to be nothing short of miraculous ... our project without SOLA would have involved a 2-3 man year effort ... SOLA provided the ability to wrap the existing APIs

13. SOLA H/W & S/W Requirements

13.1. SOLA Development Environment

Server:

Any standard J2EE Environment

Developer:

IE 5.5 or higher on the desktop

13.2. OS/390 & Z/OS:

MVS/ESA 430 or higher

CICS TS 1.3 or higher

CICS CWS; CICS Sockets

MQ if MQ transport is required

DB2 Version 7 or higher

Integrated Cryptographic Service Facility (ICSF) for XML Encryption, XML Signature and outbound SSL (if required)

G4 processor or higher for encryption (if required)

14. About SOA Software

SOA Software is the leading provider of comprehensive enterprise-class SOA management, security, and governance solutions. SOA Software's products include the award winning Service Manager™, Registry™, XML VPN™, and SOLA™. Service Manager provides a high-performance, scalable SOA Management solution. XML VPN makes it easy for companies to securely publish B2B Web services for their partners to consume. SOA Software's UDDIv3 compliant Registry is the first product to integrate service discovery with policy and performance management. And SOLA is the only production proven mainframe Web services solution for CICS programmers. These enterprise-class products combine to create the only complete SOA Infrastructure solution available today. SOA Software is a privately held company backed by leading investors including Redpoint, Mellon Ventures, Palisades Ventures Fund and Paladin Capital Group. For more information, please visit www.soa.com.