

# Platform Integration with TRIOLE Template

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**Best-of-breed systems have gained the spotlight in the open-based IT field but are burdened with high maintenance costs. Substantial labor and fees need to be reserved in order to maintain system consistency while combining open-based products. As a solution, Fujitsu presents TRIOLE Template, a verified IT platform build template, as the foundation for designing and operating a stable system within a reasonable cost. TRIOLE Template adopts various open Fujitsu and non-Fujitsu products and expands the selection lineup to meet with technological improvements and customers' changing needs. Previous TRIOLE Template application cases have shown a 20 to 50% reduction in system design/build work while maintaining stable IT infrastructure quality during operation. This paper introduces TRIOLE Template, a tool for constructing robust and stable IT infrastructure systems.**

## 1. Introduction

Open-based products have allowed users to freely select the best hardware and software products. This best-of-breed selection has become mainstream practice.

While open systems give users the freedom of selection and the advantages that follow from it, combining independent products in a single system does not necessarily extend each advantage. More likely, it makes it difficult to ensure compatibility and consistency between products and consequently makes it difficult and expensive to build and operate systems. Furthermore, many customers and engineers cannot decide which products are fit for their systems due to the diverse product lineup.

As an answer to this problem, Fujitsu has defined the "platform integration" methodology, which separates each system function of the system infrastructure layer to simplify build and compatibility verification. Fujitsu implements platform integration by following a system build

template called TRIOLE Template.

This paper gives an overview of TRIOLE Template and describes its strategy for solving problems encountered in open systems, a case example in a running financial system, the proposal and design support tool TRIOLE System Organizer, and the future potential of TRIOLE Template.<sup>1)-3)</sup>

## 2. Fujitsu's approach

For efficient construction of an IT system, Fujitsu perceives an IT system to consist of two layers and separately optimizes each corresponding work process. The top layer is the application layer, which runs applications for user businesses, and the bottom layer is the IT infrastructure layer (platform), which maintains the system's operation. TRIOLE's platform integration methodology groups components of the IT infrastructure system into functions or roles (e.g., database, system front) called blocks. The blocks can be assembled in a building-block

manner to construct many system configuration patterns. The contents of these blocks are assembled together and verified to assure system consistency and product compatibility. As compared to conventional practices in which products are built and tested per system construction, platform integration reduces the amount of complex and redundant work while promising quality during the design and building phases (Figure 1).

TRIOLE Template represents this entire methodology of verified processes and tools to build blocks and systems based on platform integration. It is used by system integration engineers to address customers' requirements for IT system construction.

By using TRIOLE Template, which is pre-verified under the platform integration concept, system integration engineers can quickly and

accurately build proven system configurations without worrying about compatibility issues or unexpected errors.

### 3. TRIOLE Template configuration

TRIOLE Template is represented in two forms. The Basic Template is a templated form of the system block explained in the previous section, and the Combination Template is a set of different kinds of Basic Templates arranged in a popular system configuration (Figure 2).

#### 1) Basic Template

A Basic Template is a build template for a single-platform integration block unit. Each Basic Template can be used independently, combined with other blocks, or built into existing systems. For example, a Database Basic

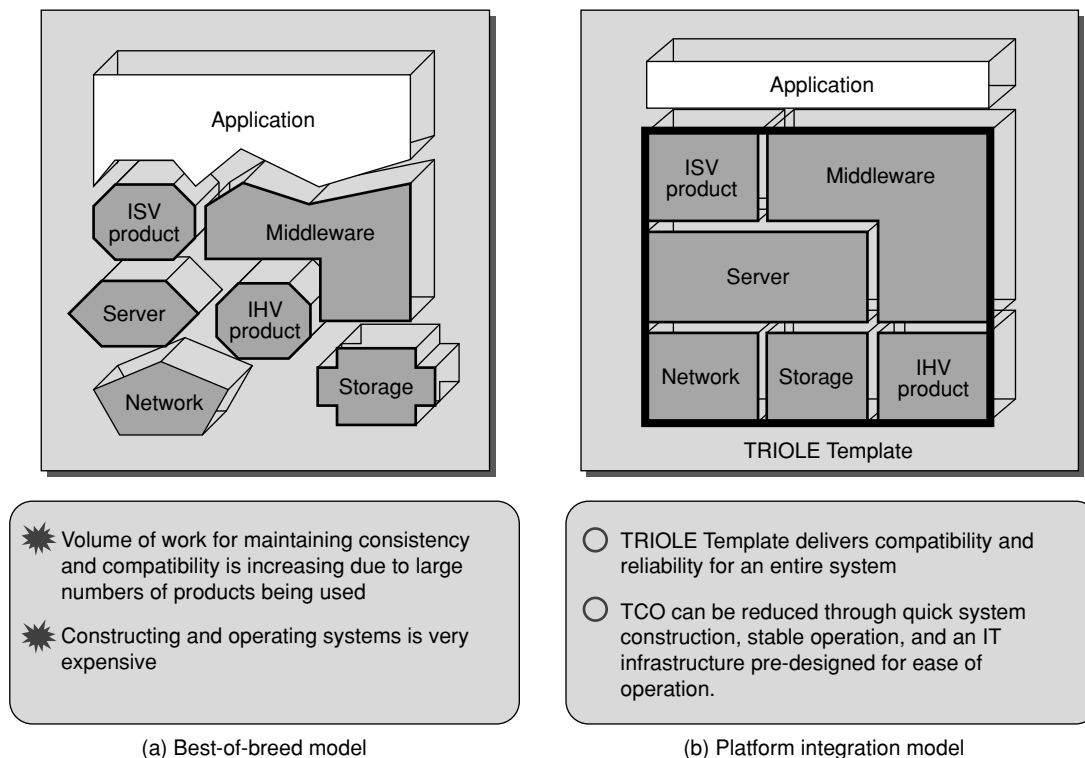


Figure 1  
Open system issues and TRIOLE Template solutions.

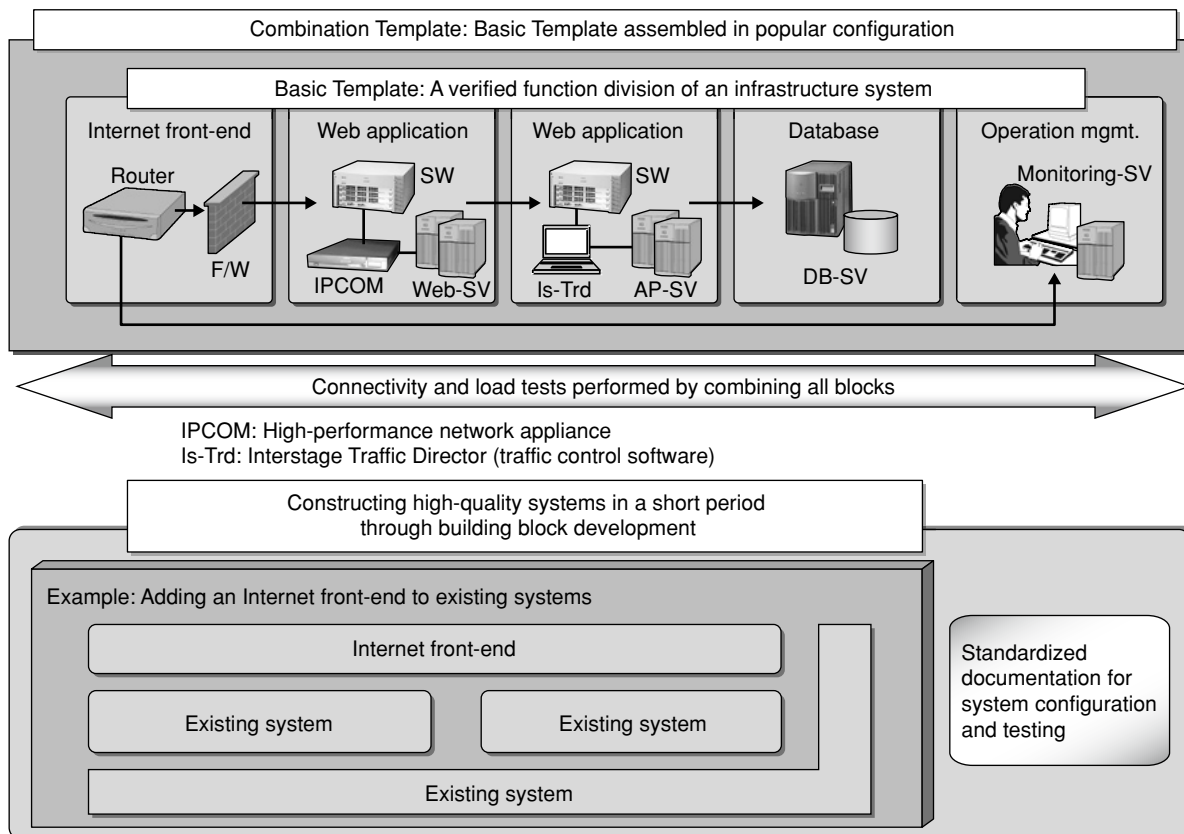


Figure 2  
TRIOLE Template configuration.

Template is used to build the database function of a system. It contains a database server, fibre channel switch, disk array units, and the software to control these hardware devices.

## 2) Combination Template

A Combination Template is a combination of different Basic Templates and is in the form of a complete system. For high reusability, Fujitsu chooses system configurations for popular use. For example, an Internet transaction system model consists of the following Basic Templates: System Front, Web Application, Business Application, Database, Backup, and System Management.

To attain high reusability, TRIOLE Templates are designed and verified for system reliability, scalability, security, and performance. The following are some of the items that are

verified:

- 1) Reliability
  - Operation continuity during machine node failover/degenerate states
  - System overload
  - Detection of failure locations and early error detection
- 2) Scalability
  - Performance (transactions/s [TPS] benchmarks, maximum performance values)
  - Server addition
- 3) Security
  - Security verification using security audit tools

The details and results of each verification item are documented.

#### 4. Integrating with ISV/IHV partners

TRIOLE Template maximizes the advantages of open systems by adopting proven and popular Fujitsu and non-Fujitsu products (e.g., Microsoft, Oracle, CA, Cisco). Because TRIOLE Template assures system consistency and product compatibility, users can freely select Fujitsu and non-Fujitsu products.

#### 5. TRIOLE Template variations

Fujitsu is ready to meet various customer needs and provides a wide TRIOLE Template lineup. TRIOLE Template is designed to satisfy various levels of common system requirements such as reliability, scalability, security, and a diverse product lineup (Figure 3). Some example variations are listed below.

- 1) Reliability
  - Cluster system

- Redundant network
  - Redundant servers/machine components
- 2) Scalability
    - Load-shared server configuration
    - Automatic server resource extension
  - 3) Security
    - Multiple firewalls
  - 4) Database lineup
    - Fujitsu Symfoware
    - Oracle HA, Oracle RAC
    - Microsoft SQL Server
  - 5) Lineup of server, OS, network equipment, and other components
    - Fujitsu PRIMEQUEST, PRIMEPOWER, PRIMERGY servers
    - Windows, Linux, Solaris OS
    - Cisco network products, Fujitsu network products

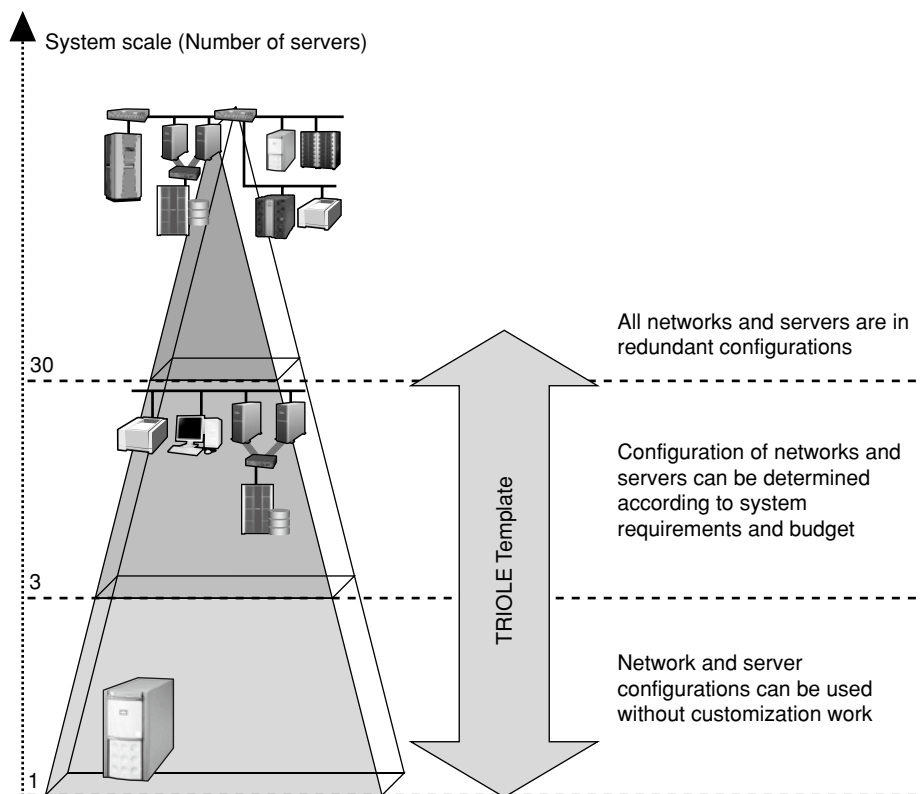


Figure 3  
Variation and scope of TRIOLE Template.

## 6. Advantages of TRIOLE Template

As discussed in previous sections, TRIOLE Template provides system engineers and customers many advantages over conventional practices in which a system configuration is designed from the beginning for each system. The following explains in detail how TRIOLE Template reduces labor costs while enhancing system quality in both the system design/build and system operation phases.

### 1) Benefits during system design and build phases

TRIOLE Template contains documented work procedures and know-how of experienced Fujitsu workers that helps engineers build a system infrastructure with minimal human and systemic errors. As a result, build work is accurate and time-effective, and the short infrastructure build phase makes plenty of time available for business application verification and system tests (**Figure 4**).

Examples of the design and construction phases are introduced below. These examples

show the maximum benefit that can be derived from the application of TRIOLE Template.

- Example 1 (system configuration: 600 blades, Linux OS)

A system for benchmark testing consisting of 600 blades was initially estimated to take approximately 30 days to become operational. By applying TRIOLE Template, the system was ready in 10 days, sparing plenty of time for application and system tests. Evaluation tests produced good results, and the system received a positive assessment from the customer.

- Example 2 (system configuration: 2 application servers, 1 database server)

The construction of a new system for development purposes consisting of several servers was originally estimated to take several days. However, by employing the environment design and server construction procedures contained in TRIOLE Template, the work was completed in a single day. This made it possible to concentrate on the development of business applications, and the system received praise from the customer for

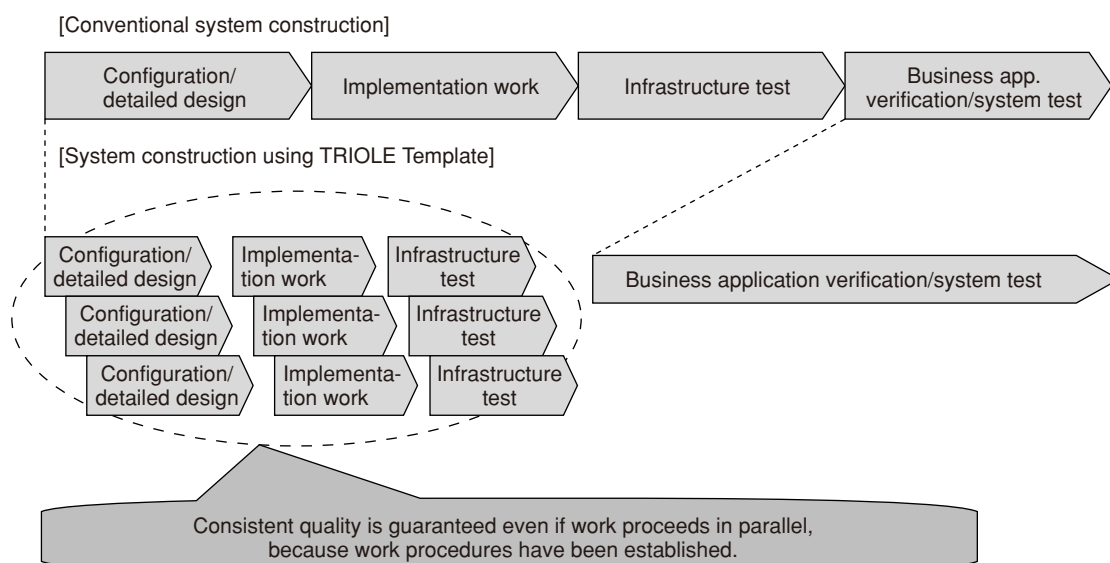


Figure 4  
Benefits of using TRIOLE Template.

its high quality.

## 2) Benefits during the system operation work phase

TRIOLE Template aims to provide reliability to maintain business operation when a problem occurs, scalability to support additions and changes to business applications, security, and operability/maintainability to allow centralized management.

Systems constructed with TRIOLE Template verified with the above aspects are robust and maintain compatibility throughout the platform. Furthermore, the stability of operation is assured through the high quality established during the system design and construction phases.

## 7. Application of Financial HUB Template to financial systems

This section introduces the application of Financial HUB Template, which is a set of guides provided with the financial business bus solution EVOLUOBUSSOLA. Financial HUB Template is used to enhance the design, build, and operation of a financial business system. Financial HUB Template is formed by merging TRIOLE Template with a system requirement definition and system design guide made specifically for financial business. The pattern of TRIOLE Template that is used contains Fujitsu's PRIMEQUEST mission-critical IA server; ETERNUS storage; and Interstage, Systemwalker, and Symfoware middleware products. See the relevant papers in this special issue for details of Fujitsu's Interstage, Systemwalker, and Symfoware middleware products.

### 7.1 Implementing Service Oriented Architecture (SOA) in a financial system

Recent trends in financial systems show an increasing number of companies attempting to incorporate the SOA concept in order to shorten the time needed to provide new products

and services. Among these, particular attention is being focused on service buses that organically link the IT systems of an entire company in order to support diversifying customer channels such as the Internet, mobile phones, and electronic payments and links between enterprises. Against this background, Fujitsu released EVOLUOBUSSOLA, a financial business bus solution founded on EVOLUO, which is a concept for financial SOA solutions that are likely to undergo dynamic changes. EVOLUOBUSSOLA is a functionally enhanced solution that incorporates general Enterprise Service Bus (ESB) functions and is designed to support the implementation of SOA in financial systems.

#### 1) Aims of implementing SOA in a financial system

Many businesses that have implemented SOA cite their primary objective as being to shorten the time needed to provide new products and services. The financial industry is no exception, and in rapidly changing strategic areas such as the Internet, mobile phones, and electronic payments, it is important to be the first to provide new services in order to maintain a competitive edge. Moreover, it is essential to construct an IT system infrastructure for doing this as quickly as possible.

#### 2) SOA implementation patterns in financial systems

When one considers SOA implementation patterns for financial systems based on recent trends, they can be summarized into the following patterns. The first pattern takes strategic businesses and channels that need to quickly provide customers and markets with new products and services, systematically converts them into services, and links them to legacy accounting systems via service buses. The second pattern is aimed at optimizing all the IT systems within an enterprise group. The first step installs a service bus in each enterprise within the group, and the next step links the service buses together. This pattern allows the IT assets within a group to be

used effectively throughout the group and constructs an IT infrastructure that makes it easy to develop strategic products and services that extend across more than one type of industry.

After observing these two patterns, including the future direction of this technology, one can conclude the following. The first step is to systematically convert dramatically changing business operations into services. To achieve this conversion, it is essential that accounting processes and payment processes are linked, while the legacy systems that support these processes continue to be used in largely the same way. These new and old systems are linked via a service bus. The second step is to begin seamlessly linking new and old services while gradually converting legacy system assets to services, or systematically adding new businesses and channels as services to the service bus.

By following these steps, the entire IT system is optimized so it can adapt to a financial business environment that is changing dynamically. Fujitsu believes this is the direction that SOA implementations in financial systems will take in the future (Figure 5).

3) Requirements when implementing SOA in a financial system

Because of the directionality referred to above, Fujitsu believes the following requirements must be satisfied when implementing SOA in a financial system:

- It must be possible to continue using legacy accounting systems and other existing systems as-is without much additional work. Even when implementing new services, accounting and payment processes must still be performed, and there is no choice but to use legacy systems in one form or another. When developing new services, one may have the option to start off by converting the minimum required legacy assets to open systems, but if one wants to provide new services quickly, it is probably more realistic to minimize changes to legacy systems.
- Because financial systems are social systems, it is essential that availability and performance be guaranteed. It is simply not acceptable if the adoption of standard specifications through an SOA implementation results in a reduction of availability

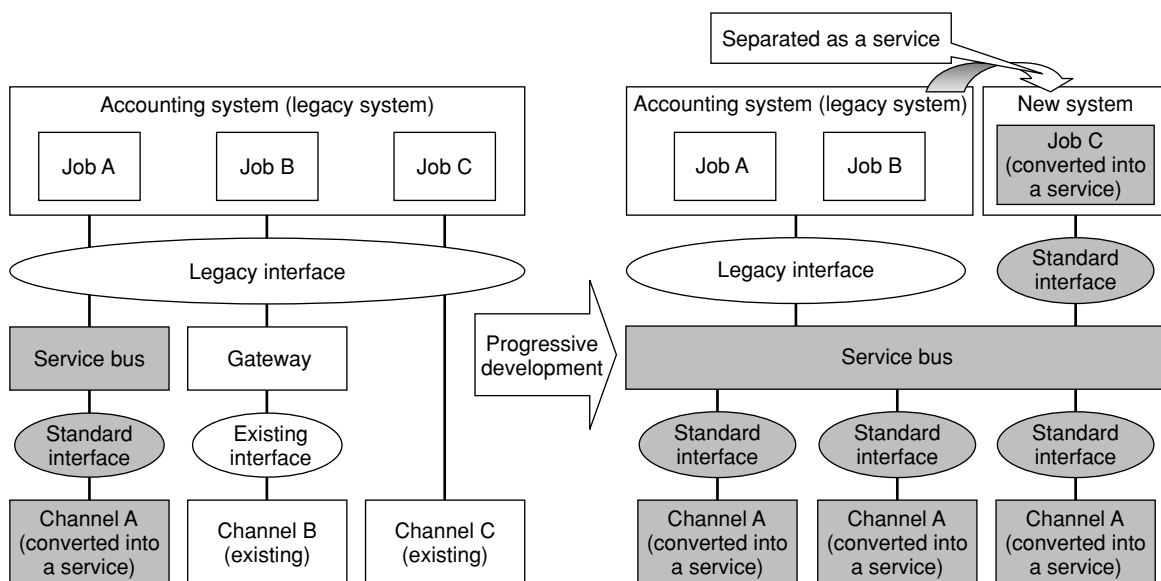


Figure 5  
SOA implementation pattern for financial system.

and performance levels.

As discussed above, it is essential to quickly build a robust IT infrastructure in order to implement SOA. By providing a secure phased migration and system extension, TRIOLE Template is effective for building an IT system infrastructure for SOA.

## 7.2 Main points of EVOLUOBUSSOLA financial business bus solution

EVOLUOBUSSOLA represents a commercial implementation of the following two enhancements:

### 1) Fast and easy connection

EVOLUOBUSSOLA is designed for quick connection with as little change as possible to the systems that connect to a service bus.

Even though EVOLUOBUSSOLA is based on standard specifications, it provides a large number of adapters compatible with a variety of interfaces, including legacy interfaces needed by financial systems.

### 2) Pursuit of availability in messaging

In addition to the synchronous and asynchronous linkage functions and broadcast functions provided as messaging functions of the general service bus, EVOLUOBUSSOLA is also equipped with a range of messaging functions suited to financial systems that need to provide high availability.

EVOLUOBUSSOLA is implemented to conduct the detailed messaging in response to various fault patterns that was formerly accomplished between conventional accounting systems and communication control devices and other components.

## 7.3 Financial HUB Template for constructing financial business hubs

### 1) EVOLUOBUSSOLA operation IT infrastructure

The IT infrastructure for EVOLUOBUSSOLA is provided to customers as an integrated product that uses Financial HUB

Template and combines hardware, middleware, and business applications (financial business bus) (**Figure 6**).

The hardware platform in particular must use hardware that can provide the high reliability and scalability demanded of a financial system. Therefore, Fujitsu's mission-critical IA server PRIMEQUEST, which combines mainframe-level reliability and robustness with the flexibility and economy of an open server, was used.

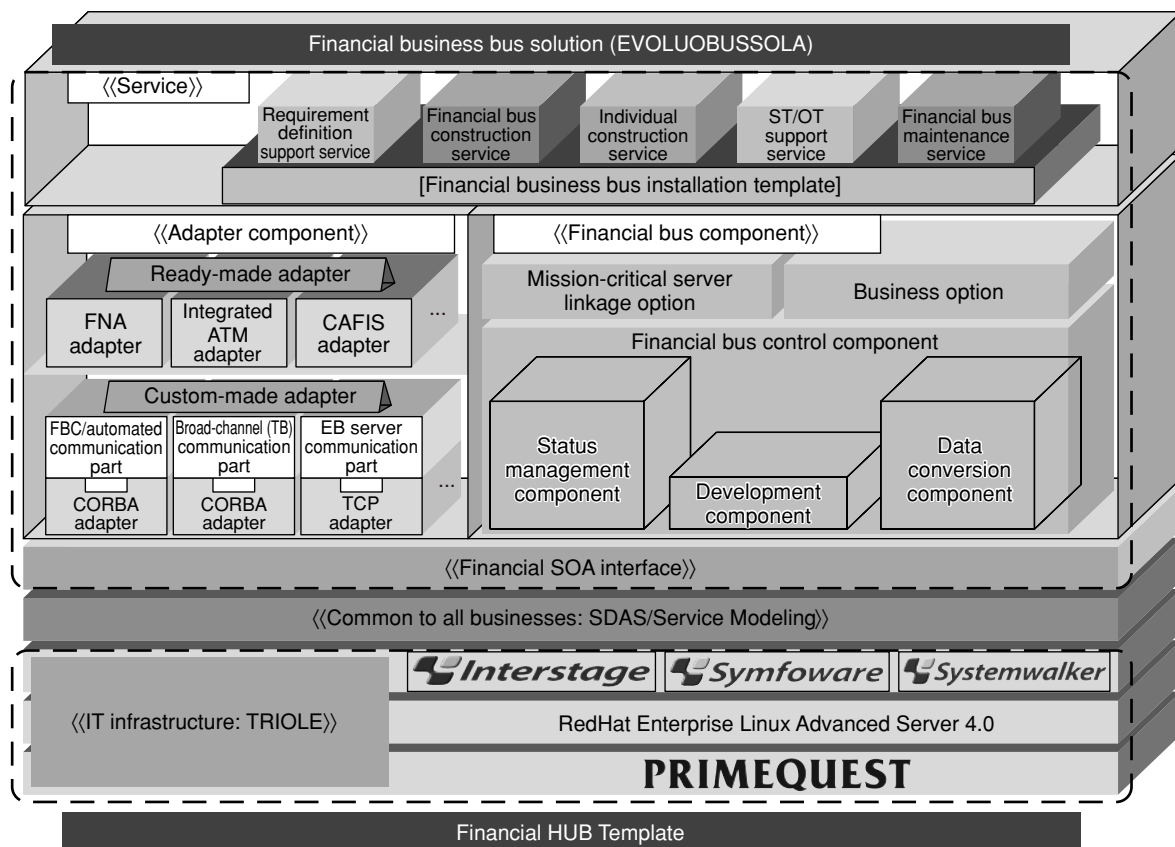
### 2) Provision of service products that provide comprehensive cover for system construction

When EVOLUOBUSSOLA is installed, it provides service products that perform tasks in system design, construction, testing, and even maintenance that used to be performed as conventional system integration tasks. Financial HUB Template, which is based on TRIOLE Template, is also provided to build EVOLUOBUSSOLA's operation infrastructure.

Financial HUB Template is specially designed for EVOLUOBUSSOLA's operation infrastructure. Therefore, in addition to the system construction manual provided with TRIOLE Template, it can also cover a wide range of processes and categories, from upstream design and system construction through to linkage tests (infrastructure) (**Figure 7**). Financial HUB Template consists of the following guides:

- A requirement definition guide that reliably maps a customer's functional and non-functional requirements to infrastructure requirements
- A system design guide that specifies details of the system architecture provided by EVOLUOBUSSOLA such as the system configuration and environment, reliability, network, performance, and scalability
- An environment construction guide (using TRIOLE Template) that specifies the hardware and software operating environments, construction procedures, and infrastructure unit test procedures





ATM: Automated teller machine  
 CAFIS: Credit And Finance Information System  
 CORBA: Common Object Request Broker Architecture  
 EB: Electronic banking  
 FBC: Financial Business Components  
 FNA: Fujitsu Network Architecture  
 SDAS: System Development Architecture & Support facilities  
 ST/OT: System test/operational test  
 TCP: Transmission Control Protocol

Figure 6  
 Financial business bus solution configuration.

- An infrastructure link test guide and operation design guide with accompanying operation shells (Figure 7).

#### 7.4 Examples of EVOLUOBUSSOLA application and the benefits of installing Financial HUB Template

Since its release in January 2006, customers in a range of fields including leading and regional banks and credit companies have adopted EVOLUOBUSSOLA, and their systems have been running stably and continuously. Previous case examples include 1) the installation of EVOLUOBUSSOLA to update a strategic channel system that continues to use the assets of a

legacy accounting system and 2) the adoption of EVOLUOBUSSOLA in a test system so that advanced control features can be inherited to link systems employed under legacy systems.

To date, all the systems in which EVOLUOBUSSOLA has been installed have been constructed using Financial HUB Template. The person-hours required for both the design stage and construction work were reduced by an average of 20% when compared to conventional methods. The same holds true for the system installation period, with systems being made available in record time. The quickest system handover so far was achieved in just three months. With regard to quality levels after

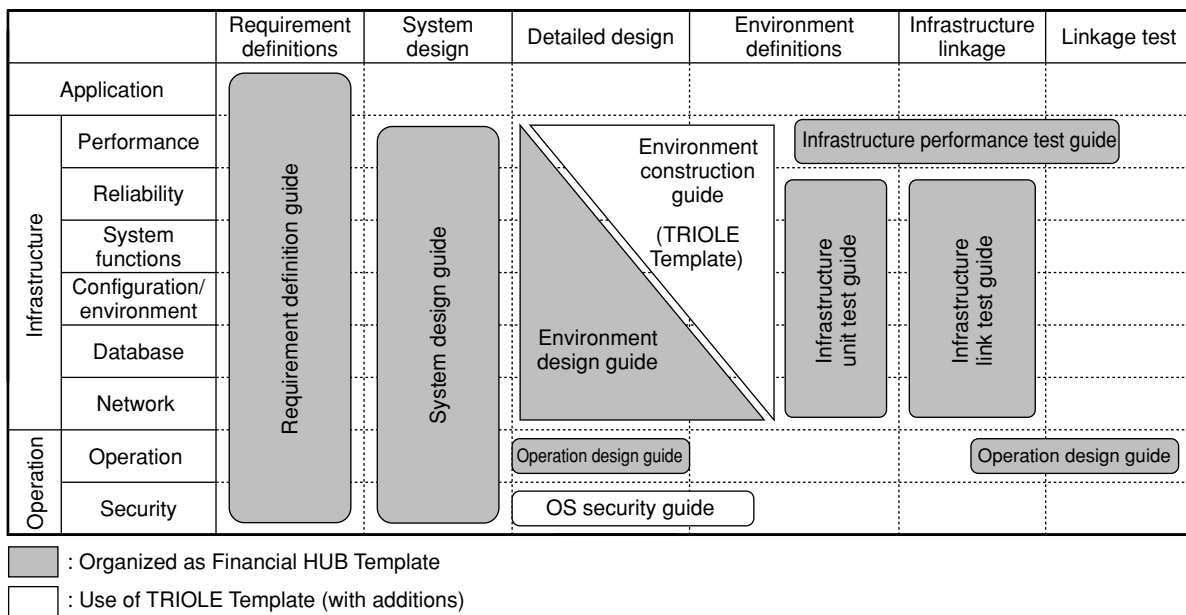


Figure 7  
Scope of Financial HUB Template.

systems are up and running, results are still being collected. However, operation tests following handover to the customer indicate that infrastructure quality is stable, and it appears that major benefits are being derived from the application of Financial HUB Template/TRIOLE Template.

### 8. Future of TRIOLE Template

To answer the latest technological demands, TRIOLE Template constantly evolves by employing the latest technologies and adapting to new trends and field requirements.

- 1) Continuous enhancements (adapting to new IT trends)

TRIOLE Template is re-verified every time an update of a product adopted in TRIOLE Template is released. This verification guarantees system compatibility and continues to evolve TRIOLE Template’s configuration, contents, and functions.

Future goals include stabilizing ITIL-based system operation and strengthening the improvement of operation performance. In addition, virtualization technologies and develop-

ments in SOA infrastructure are necessary to meet IT system developments.

- 2) System lifecycle expansion

Fujitsu aims to provide a total IT system optimization for lifecycle management, from system operation, support, diagnosis, planning/design, and system delivery. Transfer of information from the design and build phases to the operation and support phases will be improved, and automatic reflection of configuration data during the operation and maintenance phases onto design material will be enhanced.

### 9. Proposal and design support tool: TRIOLE System Organizer

As a quick solution for planning and designing an IT infrastructure, Fujitsu presents TRIOLE System Organizer, which searches its database of TRIOLE Template configuration models based on user requests for an optimal template.

It selects the system requirements and then outputs a diagram of the system configuration and estimates the construction fees, including

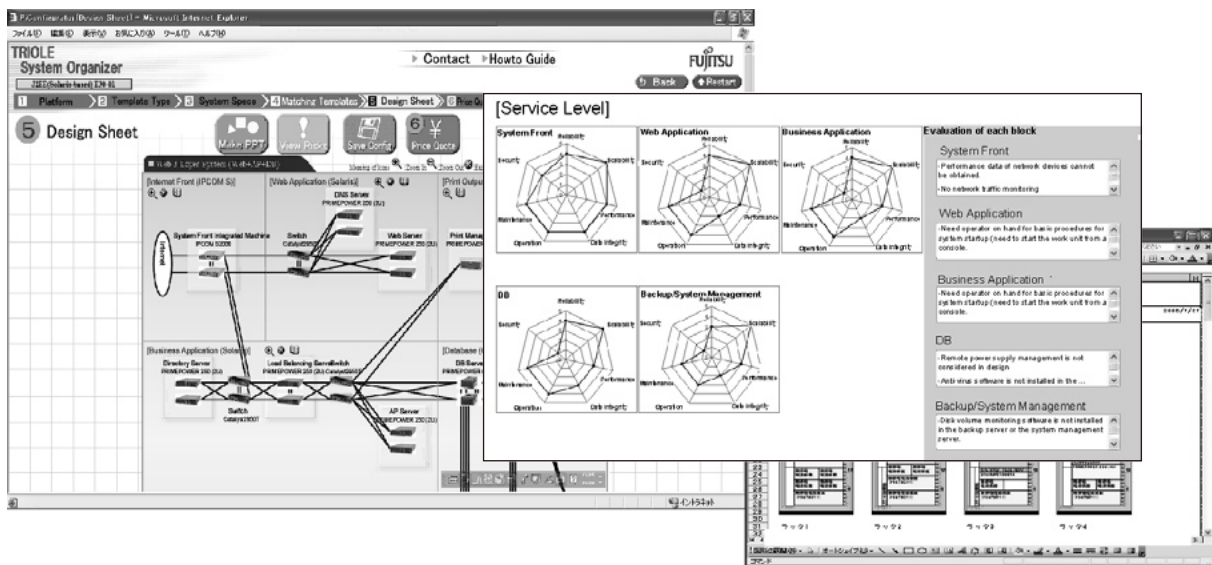


Figure 8  
Screen image of TRIOLE System Organizer.

the product costs and support fees.

Some examples of the system requirements that can be entered are:

- Reliability (single/redundant configuration)
- Scalability (server/storage unit additions)
- Processing capacity (select server/storage model that meets desired capacity)
- Platform OS (Windows/Solaris/Linux)
- Approximate cost ranges.

In addition, the extracted TRIOLE Template is displayed together with the underlying risks of the system configuration to help in the creation of service level agreements. **Figure 8** shows a screen image of TRIOLE System Organizer.

## 10. Conclusion

This paper provided an overview of Fujitsu's IT infrastructure solution, TRIOLE Template.

TRIOLE Template can be described as a technology and a body of expertise for constructing systems in open environments. It represents a fusion of open systems and highly reliable technologies cultivated by Fujitsu's experiences of developing mainframes and constructing numerous systems, especially mission-critical systems. By using TRIOLE

Template to build customer systems, it is possible to achieve excellent outcomes in design, construction, and post-operation quality under reasonable time and cost budgets.

Fujitsu will continue developing TRIOLE Template to serve customers with trusty and robust systems.

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