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The Strategic Planning for Open Systems Environments

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Abstract

Open systems provide programs portability, systems interconnectivity, and user portability. In order to have these benefits, de jure and de facto standards are the open public specifications for computer industry and user groups to follow. Computer systems can be classified as four layers: computer hardware, operating systems, software tools, and application programs. There is an open system layer model to describe the suitable open standards in each layer. This will provide a very clear picture for system planner to implement his open system. Any two adjacent layers in this system model can be viewed as a simple “supply/demand” relationship. When open system is available, it really shows how benefits can be realized. Basic open systems definitions and their implications are clarified. Legalized processes for international open standards are demonstrated. For enterprise system planner, the strategic policies for planning open systems environments are shown. These planning strategies are very important if any computer user groups seriously consider to build open systems environments.

key words: open systems, de jure standards, de facto standards, portability, interoperability

1 Introduction

In the rapid development of information technology society, open system concept is one of the most hottest issues in computer industry. From end user’s point of view, open system really provides investment protection and avoids proprietary lock in. People usually classify the system as four layers, i.e., computer hardware, operating systems, software tools, and application programs [1] [2]. Computer hardware consists of computer physical components, such as CPU, RAM, secondary storage, etc. Operating systems are the resource manager, which

schedule and allocate system resources. Software tools support working environment for application programs in the computer platform. Database management system, graphical user interface (GUI), and network communication software are the typical software tools. Application programs are software for any specific application areas, such as inventory system, banking system, airline reservation system, etc.

1.1 Benefits for Open Systems

The benefits for open systems are software portability, system interoperability, and user portability. If application programs and software tools are portable, the development costs for application programs and software tools are decreased significantly. Incidentally, the market shares for these software products can be increased due to the wide range of available platforms. The primary reasons for interoperable system are resource sharing and information exchange. As for user portability, retraining cost for end user to familiar with the system can be avoided. This increases and users productivity if they are relocated. In order of introducing new system, the user resistance factor can be eliminated.

There is an open system layer model in section 1.2 to explain the system layer relationship. Each layer in the system must follow standards to meet portability and interoperability criteria.

• If application software follows API (Application Program Interface) standards, such as X/Open CAE (Common Application Environment), this application software can be ported in any compliant software tools, which satisfy API standards. Source code portability is the most attractive feature for application program developer. Because the restructuring overhead for this application program to adopt different software tools can be reduced significantly. The other software portable standards, ABI (Application Binary Interface), are more difficult to implement unless the computer processor is almost identical.
• Because communication cost for high speed network is reduced and the computer system is tend to be distributed, the demand for system interoperability is increasing tremendously [3]. The ISO/GSI network protocols are the standards to follow. At this moment, DoD TCP/IP, IBM SNA, and DEC DSCNet are network standards for major market shares.

• The objective for user portability is to provide an integrity user interface for end user. The retraining cost can be reduced if the system supports integral user interface. Microsoft window, X-window (Motif and Open Look) are major graphical user interface (GUI) standards for personal computer and workstation platforms in today computer industry.

1.2 Open system layer model

At this moment, there is still act a standard model to describe open system layer relationship. An open system layer model is given in this section. Shown as follows (Figure 1).

In today computer industry, it is almost impossible for a computer hardware or software manufacture to develop system layer from bottom to top. In fact, each layer with its adjacent layer can be defined as a simple “supply/demand” relationship. In this system layer model, each lower layer can be the supplier for upper layer and upper layer can be the consumer for its lower layer. That means, the benefits for implementing open systems are not restricted to the application programs developer.

![Figure 1: Open systems layer model](image)

Above model shows the importance of implementing standard interfaces. Traditionally, the market is always determined by the supplier. For example, Microsoft DOS is an operating system layer in this model, if any DBMS system developer want to implement a product on DOS, he must follow DOS system interfaces. Otherwise, there is an incompatibility problem between DOS and DBMS. This problem also happens in the interfaces between application programs and software tools. So standard interfaces provide a fair market competition.

There is a MUSIC model, which also provides a very good framework to describe the open system architecture [4]. MUSIC is abbreviated for Management, User Interface, Service Interfaces for Programs, Information and Data Formats, Communications Interfaces. This model was developed by the Central Computer and Telecommunications Agency (CCTA) and it provides a rule for the procurement and specification arm of the government of the United Kingdom.

From above discussion, the benefits for implementing open systems are quite obvious. So open systems do have incentives for the computer industry and related information end user. In the academic research community, the importance is also increased recently. For example, ACM is going to publish a journal called StandardView in this coming July 1993. Because the academic community is research oriented, it is more suitable to build up heterogeneous system environments and to analyze the feasibility of implementing open systems.

This paper demonstrates strategies to plan open system environments and problems need to be solved before open systems benefits can be obtained. These strategies apply to any enterprise environments, which their developers seriously consider to build up open systems and to gain those benefits.

2 Open Systems Definition

Different people and organization have different interpretations for open systems. The specific open systems definition was adopted from the IEEE POSIX 1003.0. [5]. Shown as follows:

“Open system is a system that implements sufficient open specifications for interfaces, services, and supporting formats to enable properly engineered applications software to be ported across a wide range of systems with minimal changes, to interoperate with other applications on local and remote systems, and to interact with users in a style which facilitates user portability”.

More specifically, the term open specification can be defined as:

“A public specification that is maintained by an open, public consensus process to accommodate new technology over time and that is consistent with standards”.
This public specification is sometimes called de jure standard. A de jure standard is created by a formally recognized standards developing organization. It is developed under rules of consensus in an open forum in which everyone has a chance to participate. A de facto standard is the term applied to a product or system from a provider that has captured a large share of the market and which other providers tend to emulate, copy, or use in order to obtain market share.

From this definition, we know that open system can be characterized as three coordinates: interoperability, portability, and integrity.

• If a system provides exchange of information among various components of similar levels, then it supports interoperability. In order to have this capability, a system must follow connectivity standards: OSI seven layers protocol. Based on this de jure network standards, interoperability can be achieved in homogeneous or even heterogeneous systems. TCP/IP is a de facto standard for internetworking.

• If a subsystem can be moved from one environment to another, then it supports portability. X/Open API standard (CAE) for source code portability is the most attractive one for application developer. IEEE POSIX P1003.x are series of portable operating systems de jure standards.

• A system provides a consistent user interface, then it supports integrity. Microsoft Windows is the de facto standards for PC platforms. X-windows, includes Motif and Open Look, are the de facto standards for workstation and high end computer platforms. As for GUI de jure standards, it is still not finalized yet.

3 The Status of Open Systems

In the proprietary systems environment, computer system consumers were locked in because of system was incompatible with the outside world. Computer system suppliers usually dominate consumers by closed system characteristics. In this case, computer markets are steered by supplier sides.

Recently, the user community found this unfavorable situation must be reversed. The U.S. government, one of the biggest end users in the computer industry, requests all the federal procurement policy must satisfy NIST (National Institute Standards and Technology) standards: FIPS (Federal Information Processing Standards). All the associated commercial companies also follow in, includes Boeing, Kodak, etc. Hence, open system was driven by one of the biggest computer users, i.e. U.S. government. Finally, it was followed by other commercial end users. Now, let's see how the international de jure standards are legalized.

3.1 Standards Organizations Classification

The organizations and consortia develop de jure standards can be classified as 4 levels [4]:

1. international standards organizations: ISO, CCITT, ITU, IEC, etc.

2. regional standards organizations: AOW, CEN, ECMA, EWOS, etc.

3. national and governmental standards organizations: ANSI, NIST, DIN, BSI, AO IEEE, etc.

4. standards consortia and user groups: X/Open, UniForzahlen, OSF, UI, COS, MAP/TOP, etc.

Standards recommendations are first initiated by standards consortia and user groups, then approved standards are followed up by national standards, regional standards. Finally, international standards organizations approve the final worldwide acceptance standards. So this standardization process is a long duration procedure. Even now, there are still lots of de jure standards needed to be processed and revised. So, if an organization developer is to plan an open systems environment based on these de jure standards, he needs to understand the recent legal standard status.

4 Experiences of Open Systems

Here are some experiences of implementing open systems from user groups and computer industry.

• User groups: after in-depth study, DHL, one of the world's largest international air express companies, moves to the open systems environments in 1988. The reason for this decision is the worldwide transshipment location needed to be interconnected. Unix operating systems provide this capability to connect different computer platforms and to share the package mailing information. British Airways was based on similar reason to take the open system strategy. As for the financial company, Shearson Lehman Hutton uses Unix based minicomputer for its securities trading purpose. In such a way, clients are more easy to send and receive their trading transactions from different computer platforms [2].

• Computer industry: as for computer manufacture industries, DEC, SUN, IBM are taking the open
systems development strategies very positively [4] [6] [7]. These computer manufacturers base on internal computer networks and operating systems, de jure standards, for their products’ migration policies [9][10].

1. Interoperability: IBM integrates SNA, TCP/IP, and OSI network protocols [8]. DECnet/OSI Phase V supports the integration of OSI protocols and provides compatibility with DECnet Phase IV and TCP/IP [6].

2. Portability: DEC uses OSF/1 operating systems for its new Alpha workstation products. IBM also considers migrating its AIX operating systems to AIX/OSF. SUN promotes Solaris as the future operating systems. IEEE POSIX provides application programs’ portable interfaces for proprietary host computer operating systems, such as VMS, MV3, etc.

3. Integrity: IBM and DEC support X-window with Motif version. While SUN sticks to X-window with Open Look version. Both of these versions are de facto standards. Once de jure standards are finalized, the future GUI market trend is clear.

5 Example: Open OLTP Systems

This paper gives an example from existing commercial software to demonstrate the migrating policy for computer development and general IT users.

Online transaction processing (OLTP) system is one of the most important computer processing systems for business applications. The OLTP system composed of application program (AP), transaction manager (TM), database management system (DBMS), operating system (OS), and database. The proprietary OLTP systems include: IBM CICS, DEC ACMS, Tandem Pathway, etc.

The X/Open consortia defines a set of open interfaces between TM and DBMS [11][12]. This set of open interfaces provide open connectivity standards for any TM and DBMS. So the TM can implement a two phase commit protocol with any associated DBMS provided that those DBMSs do have the standard interfaces. IBM, DEC, and other computer industry key players have committed their products with the X/Open set of open interfaces. Existing open TM products are: ATT TUXEDO, NCR TOP END, DEC TP/Frame, IBM CICS/AIX, Transarc Encina, etc. [14][16].

In order to be compatible with existing TM products, DEC adopts the MIA consortium policy for its ACMS to meet X/Open set interfaces. IBM and other open TM developers have similar migrating policies. In case of implementing distributed transaction processing (DTP) model, the remote procedure calls (RPCs) are the primary message passing mechanism between TMs on different platforms. Unfortunately, international RPCs standards are still under development. SUN RPC/XDR is one of the most important de facto standards in today distributed applications commercial markets [16].

Usually, these TMs are implemented on workstation level only. There are still many application programs operating on proprietary mainframe TMs. Unless the open TMs’ experiences are matured enough, end users will still switch back to open TMs. A smooth migrating strategy is necessary if they decide to move forward to open systems environments.

6 Strategies to Planning Open Systems

As we know, building an open system environment for an organization is not an easy job [4]. There is not a single correct answer for this planning process. Factors needed to be considered include existing hardware and software investments, user needs and demands, critical applications consideration, unknown future technology, and limitations on resources.

Application environment profiles (AEPs) are blueprints for an organization to develop its open systems environments. This AEP documents compose of open standards and organization site application specifications. Open standards were developed by open system societies, such as X/Open XPG, OSF AES, NIST APP, etc. And site application specifications are planning rules for individual organization. This AEP can be upgraded from department, enterprise, to a group of companies in the same market share.

There are several important issues for users to consider while they are building open systems environments for their organizations. The strategies for planning open systems environments can be shown as follows:

1. Why the open systems environments are necessary?

Even open system is very attractive idea for end users to carry out, it is not always appropriate to apply all the user groups immediately. For example, open OLTP system is not feasible for mainframe users, such as banking, airline reservation, etc. Because it lacks of working experiences. But sometimes open system is the best solution for a specific application domain. For example, when enterprise considers vertical or horizontal integra-
tion with its associated clients. To satisfy the connectivity constraint, everyone must have the same network protocols, i.e. ISO/OSI. DHL and British airway are the typical examples. They need to inte-
grate their department horizontally and run their business. Open systems can also save money while APs are implementing on the same API. Without revising AP source codes, AP developers can port their program easily between departments in the same enterprise. User portability can reduce the retraining cost if the AP is based on the same user interface. This will provide the enterprise a smooth restructuring process.

2. Are there any impacts to your organization to adopt open systems?

To adopt an open system really has some impacts for the organisation. System connectivity, AP portability, and user portability are benefits for the enterprise to reduce its cost. But the side effects are the security weakness, AP development overhead, and user resistance. The unfriendly users are more easy to break in the system because of the connectivity nature. The AP developer must more careful to design his AP to meet API standards. If the old system doesn’t have the standard API, sys-
10 tem enhancement or discard are necessary. These will increase the system development cost. Finally, portable user will make the original technical territory broken. Some users resist this policy to protect their special skills.

3. What are the major components for your open systems?

Network, operating systems, and user interface are major components for open system environments. There are also some additional components to es-
15 tablish a complete open system. For example, an open OLTP system needs transaction manager, ap-
llication programs, and database management sys-
tems to establish an open environment. The sys-
tem planner must follow enterprise’s AEPs to check whether those standards are satisfied. And what manufactures’ products are available to open standards.

4. Are they feasible to adopt open environments?

To adopt open environment is a very attractive idea for an enterprise system planner. But it is not always feasible for all the enterprise at this moment. Some of the business computer systems have been run by proprietary products for a long period of time. It is not mature enough to adopts the open systems completely. For example, worldwide airline reservation system is still based on IBM systems. Major electronic banking and securities trading sys-
20 tems are also handled by proprietary systems. This is because open system’s benefits can not compe-
sate for losing proprietary price-performance ad-
ventages and the technology for integrating all the open system components are not well defined. In commercial society, it is usually more conservative to adopt a new idea while the system are not ma-
ture for its working experiences.

5. How about migration from proprietary environments?

Once open system strategies were decided by the enterprise system planner, the migration process must be clearly defined. If a brand new system is set up, the migration process is much simpler. The system planner only have to define the enterprise AEPs and observe international ongoing standards. If an established proprietary system needs to be mi-
gated, the migration process is more complicated. The migration step must be scheduled precisely. The migration overhead is very high when compared with no migration. But in the long run, this overhead will be absorbed. Usually, major computer manufactures will have the strategy to follow open standards and provide migration services to their clients. So system planner can consult manufactu-
25 res’ open products delivery schedule and plan his migration process.

7 Conclusions

Open systems are the future trend for the entire computer industry. The real meanings and implications are always variant from different community. So it is very ambiguous for people to understand. This paper defines open systems and it really clarifies those ambiguities.

Open systems can be defined as three coordinates: interoperability, portability, and integrity. These coordinates are associated with system, application, and people. Open standards can be classified as de jure standards and de facto standards. These standards provide the directions for those coordinates.

An open system layer model was presented in this paper. This model uses “supply/demand” relationship between any two adjacent layers. When open system is available, it really shows how benefits can be realized.

This paper also showed the status of open systems and what are important incentives for people to adopt open systems. The open standards legalized process were also demonstrated. Some of experiences from computer user groups, industries to implement open envi-
30 ronments were studied also. A typical business example, open OLTP, was given to explain how open standards were applied in the real business environments.
Finally, strategies to plan open systems were given. These strategies are very important issues for any enterprise system planners to seriously consider in adopting open systems.

References


