Innovative VDI Standards: Moving an Industry Forward

Michael L. Kasavana, Ph.D., NAMA Professor in Hospitality Business,
Michigan State University, USA

ABSTRACT

Effective self-service automation requires data sharing among non-proprietary system components. Historically, the original self-service provider, the vending industry, has failed to develop and implement open architecture standards that enable seamless data sharing among disparate devices and servers in a network. This lack of interoperability among the main entities in a sophisticated vending system (e.g. vending machine controller, telemetry device, vending management software, and cashless payment equipment) has contributed to a lack of innovation and creativity in the evolution of unattended point-of-sale retailing. Recently crafted Vending Data Interchange (VDI) standards from the National Automatic Merchandising Association (NAMA) provide a non-proprietary means by which to share machine-level data among diverse technology providers. The VDI standards are designed to ensure reliability, continuity, and longevity among installed hardware, software, and netware. In essence, VDI standards contain technical specifications that bundle vending machine-level data for easy distribution throughout a vending operator's technology network and can be implemented by a qualified provider without operator involvement.
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INTRODUCTION

The NAMA Technology Leadership Committee, under the direction of the NAMA Board of Directors, formed a specialized technology task force charged with developing data interchange standards that could be implemented industry-wide. The task force was directed to develop a set of data transport protocols enabling the sharing of vending machine data among competing back-end technology providers. These standards had to ensure reliability, continuity, and longevity. Reliability relating to each participating technology provider of a vending operator receiving identical data files, continuity in terms of data retrieval and distribution throughout a vending operator's network, and longevity by providing assurance to vending operators that interfaces between installed applications would remain viable going forward. As a result, the task force produced NAMA VDI (**V**ending **D**ata **I**nterchange) standards. These standards contain technical specifications that bundle vending machine-level data for rapid distribution throughout a vending operator's technology network and can be implemented by technology providers without vending operator intervention.

Simply stated, vending operators desire technology capable of reliably passing data sets from one application service provider to another so that multiple application service providers can contribute to a single networked solution. The essence of the NAMA VDI standards is to enable data movement through a messaging technique that ensures data integrity of a transmitted set of data, regardless of whether it was pulled or pushed to a server. In other words, NAMA VDI standards render vending technology capable of linking together diverse software solutions, from different vending technology providers, into unified applications and likely represent a tipping point in the accelerated adoption of vending technologies as operator concerns related to supplier-dependence are significantly reduced.

Data Sets

NAMA VDI is an innovative set of protocols designed to package vending machine-level data (e.g. DEX and MDB data, alerts data, cashless transaction data, etc.) into a message format that can be shared among diverse supplier systems to enable multiple software applications on the identical data set. For example, consider the situation in which a telemetry provider remotely polls DEX data from a vending machine (e.g. Company "X"). The telemetry provider transfers machine-level generated data file to its server (e.g. "X" Server). The server in turn authenticates the file with a NAMA VDI message wrapper and labels its contents for subsequent communication to any other provider's server in a vending operator's network (e.g. Company "Y" or Company "Z" etc.). Additionally, the vending operator may have machine-installed cashless readers that collecting electronic payment data for transmission to cashless gateway for reconciliation. The polled data set would consist of both DEX data and electronic payment data and packaged into an aggregated data set. Movement of the data set to a host vending management software (VMS) system capable of processing DEX data could occur while simultaneously forwarded data to a cashless gateway system could be applied for processing and settlement. This multiple tasking one a single data set is indicative of the robust nature of VDI messaging.

The functionality of VDI standards is somewhat analogous to an email communication in that the file of machine captured data file forms the content of the message while VDI programming places a wrapper, akin to an email message envelope that enables distribution among any number of file servers (e.g. email recipients), regardless of supplier, provider, or manufacturer. NAMA VDI standards, for example, allow for DEX data to be transmitted by a telemetry device or server in real time. This approach provides a platform for a vending operator's VMS to upload data nightly for use in pre-packaging (also referred to as pre-kitting) and/or dynamic scheduling algorithms that rely on variable replenishment strategies. The goal of NAMA VDI standards is to ensure that a vending operator can confidently implement multiple, diverse vending technology solutions while utilizing operational data in existing application software (regardless of supplier). NAMA VDI specifications are open architecture technology standards designed to be extensible, uniform, stable, and manufacturer neutral.

Vending Technology

More than two decades ago, in an effort to standardize the control of machine-level transaction and event data collection, storage, and transmission technical specification committee members of the National Automatic Merchandizing Association (NAMA)[i] and the European Vending Association (EVA) collaborated to develop a set of protocols necessary for efficient data handling and processing. [i]One of the outcomes of this effort is DEX data. DEX, which is an acronym for Data EXchange standard, is capable of capturing machine-level cash in/out data, product movement data, and financial audit data. DEX data is designed to assist operators with product replenishment strategies, product mix rotations, and cash management safeguards. In order to optimize contribution margins, while controlling operating expenses, DEX data plays an important role in productivity and profitability analysis. Accompanying the advent of DEX, a Data Transfer Standard (DTS) was devised so that the DEX data could be exported from the machine in a decipherable electronic format. Once the data was transmitted, it could be entered into a vending management software system (VMS) and used in combination with product mappings to evaluate route coverage, cash handling procedures, and sales performance. It is for this reason that the DTS protocol is often considered an integral part of the DEX standard; not a separate element.

More recently, the Multi-Drop Bus (MDB) protocol emerged is an internal communication protocol designed to ensure that coin mechanisms, bill validators, and cashless payment devices could be effectively interfaced to a vending machine controller (VMC) without regard to proprietary manufacturing specifications. MDB, often compared to USB standards used in generic computer component interfacing, replaced prior practices built on supplier-specific design connectivity. An MDB cable (also termed a machine harness) provides the physical connectivity for attaching peripheral devices (e.g. card reader, bill validator, etc.) to the VMC of a vending machine. MDB is credited with initiating the movement toward open system architecture in vending technology. Since vending machine-level data capture involves the retrieval of stored audit information (akin to a snapshot) via local or remote transfer, there is a need to apply data in various ways to produce a comprehensive analysis of transactions. In fact, some telemetry providers actively monitor the MDB bus to detect, in real-time, product movement and operational alerts (e.g. bill jam, change shortage, door open, temperature variance, etc.).

As a result of prior developments, vending machine-level data formatting and content derivation conforms to the European Vending Association-Data Transfer Standard (EVA-DTS) and provides access to system status data, transactional data, and machine configuration information. In a typical data connection, a polling device actively surveys the vending machine for stored data then follows DTS standards for transmission to an external device. Once the data transfer is complete, the received vending machine-level data can be wrapped in a NAMA VDI message format for subsequent distribution to installed vending system servers (see Figure 1).

DEX Data Collection	>	**DEX Data Extraction**	>	**DEX Data Transmission**	>	**NAMA VDI Standard**

Figure 1. Machine Data Transmission to NAMA VDI Application

MDB Standards

A more recently developed vending machine technology standard than DEX is the multi-drop bus (MDB) standard. Vending machines have one master communication channel and it is labeled the vending machine controller (VMC). The role of the VMC is to define the functionality of peripheral equipment (coin changer, bill validator, card reader, etc.) that must be interfaced with the electronic circuitry of the vender to work properly. MDB is the short form of multi-drop bus/internal communication protocol (MDB/ICP). MDB/ICP is an open global standard governing the interface between a vending machine controller and payment system peripheral devices and is maintained by NAMA and the European Vending Association (EVA). The MDB standard defines a serial bus interface for electronically controlled vending machines. It also standardizes vending machines that employ electronic controls so that all vending and peripheral equipment communicate identically.

Basically, MDB defines and performs as the serial bus interface for electronically controlled vending machines. It also standardizes processes for vending machine interoperability and communication among various peripheral components (i.e. coordination and validation of peripheral equipment interactivity). The serial bus, or MDB, is typically configured as a master-slave arrangement enabling a single master the capability of communicating with up to thirty-two peripheral devices. The VMC serves as the system master unit. The purpose of MDB is to ensure that the necessary functionality of any device on the bus (i.e. interfaced peripheral equipment) is compatible with the capabilities of the VMC. Hence, the software employed by both the peripherals and VMC must be compatible, but not necessarily at the same level of capability in order to establish peripheral functionality. Within the MDB standard, the capability of each peripheral device is designated by a classification Level identifier. Levels of peripheral functionality were established in response to the addition of major extension in the capability of add-on devices. Level designations are used to avoid potential conflicts that may arise when a VMC Level and a peripheral Level are incompatible. Should this occur, neither the VMC nor the peripheral will be able to issue or reply to a command not supported by the device.

For example, connecting a Level 2 MDB peripheral device to a Level 1 VMC creates a condition of incompatibility that prohibits the proper functioning of the peripheral device (e.g. payment acceptor). The current level for the MDB standard is referred to as Version 3/Level 3 (first introduced March 2003) that pioneered the incorporation of features associated with cashless transactions. In essence, the VMC must initially determine the Level of a peripheral device in order to determine the command set to communicate with the device. A VMC can only issue commands that are supported by the peripheral. For example, a Level 3 command may only be issued for a Level 3 or higher peripheral and will not work with a command issued for a Level 1 or 2 peripheral. A cashless payment peripheral, for instance, deciphers the Level of a VMC through a setup command designed to establish compatibility and functionality.

A compilation of component Levels indicates varying functionality among installed peripherals. For each classification of peripheral device there are a set of mandatory requirements that equipment developers must adhere to ensure compatibility and Level designation. It is a fundamental principle of the MDB standard that all peripheral devices must be implementable with both backward and forward compatibility relative to a machine VMC. The VMC typically gravitates to the highest common Level among peripheral devices.

MDB Interfaces

MDB/ICP enables the VMC to determine what coins the coin changer, and what bills a bill validator, can accept as payment. Additionally, MDB/ICP establishes the amount of credit available through a payment card reader. Through coordination of components, the VMC is able to manage and direct the coin changer in determining how much change to pay out; bills to recycle, or outstanding credit balance to return to the card. There are additional peripheral devices, beyond coin changers, bill acceptors, and card readers, like paykey and other closed systems, for which the VMC can be configured via an MDB interface. Historically, the manufacturer of components being placed into a vending machine had to manually define technical functionality among machine components. Since each component manufacturer acted independently, a number of proprietary device interfaces emerged. The problem with a proprietary interface is that its uniqueness adds unnecessary costs and complexity to vending machine configuration and operation. The MDB/IPC standard was adopted to establish a communication method that allowed the devices in a vending machine to use a common interface. Despite the fact several devices can tie into the same MDB interface, each will operate independently on the interface. Since each interfaced device is assigned a unique address, the VMC can determine which device is active and communicating.

A majority of vending machines support the MDB/IPC standard and thereby are capable of allowing a vending operator to choose payment and other devices primarily based on reliability, performance, and price. Since the MDB/IPC standard establishes the manner by which each component device communicates with the VMC, the connection to each device tends to be identical. Every device has basically two MDB/IPC connectors to allow it to both connect to the MDB/IPC bus in the machine while providing a linked connection to another device (if needed). This design reduces the number of

MDB connectors needed as well as allowing for additional devices. Hence, adding an additional peripheral device to a vending machine is simplified since the requisite hardware and bus connectors to add the device are already in the machine. The MDB/IPC is an internationally supported interface. Through the cooperative efforts of the National Automatic Merchandising Association (NAMA) in the U.S. and the European Vending Association (EVA) and the European Vending Machine Manufacturers Association (EVMMA) in Europe, the standard was developed with provisions for varying currency acceptance and payment technologies.

MBD and DEX

Technically, the MDB/IPC standard defines a serial master-slave communication bus used by the internal devices in the machine, like the coin acceptor. MDB allows for instantaneous updating of the current status of the machine (i.e. data changes as each product is sold). It is for this reason that the MDB standard is considered a transaction-based mechanism, unlike DEX, which is a cumulative-based reporting system. The MDB protocol allows for the attachment of an audit (DEX) device that, acting as a passive slave, receives information of all events that happened on the machine (e.g. vends, sold outs, coins and bills accepted, etc.). On the other hand, DEX involves the retrieval of stored information (a snapshot) through a serial plug designed for connectivity with a handheld terminal (HHT) or small PC. The connection conforms to the EVA-DTS standard and provides access to status data, testing routines, and machine setup. In a DEX connection, the connected device actively polls the machine for stored information.

Cashless transactions are not dependent on DEX but rely on MDB processes. The fundamental difference between DEX and MDB is that MDB is the only method for a bill acceptor or a coin changer to report credit deposited to authorize a vending transaction. DEX cannot do this. This fact makes it necessary to have MDB installed; DEX, while needed for sales reporting, is not mandatory for the machine to operate. Hence, from a cashless payment perspective, MDB is more useful than DEX since it details the transaction (card number, transaction value, product(s) sold, date, and time) for reconciliation. The results of the transaction will be posted as an MDB record. For operators not employing cashless vending, DEX data is often sufficient to provide necessary information for a vending management system. It is for this reason, some vending operators only use MDB for cashless transactions, and ignore DEX data. For those operators desiring DEX data, a DEX cable can be used to transfer the DEX file along with the cashless MDB data.

DEX is the key to technological advancements in the vending industry worldwide as it enables data capture at the point of purchase. DEX has earned international recognition and support and can be used to facilitate consistent data formatting throughout the vending channel. In the past, machine manufacturers varied in how data exchange transmissions occurred. In response, DEX designers and equipment engineers have established standards governing data recordation, file formatting, and file exportation through common interface linkages. As a consequence, vending machines are manufactured as DEX-enabled and are often labeled “DEX-compliant.” From a sales perspective, DEX provides the vending operator the ability to track brand and/or product preferences at the point of purchase. DEX has been found to improve sales performance, reduce operating expenses, and minimize machine malfunctions. In addition, DEX enables space to sales analysis, for machine-level column allocation optimization, in vending management software. This is an important outcome of a DEX-compliant device. The main benefit of line item tracking is accountability and machine plan-o-gram (i.e. rotating menu of product offering) development.

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