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Ford Launches the ePIM Initiative

Using WebSphere and MQSeries to Integrate Disparate Enterprise Applications

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March 2002

Prepared for IBM

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TABLE OF CONTENTS

ILLUSTRATIONS

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Executive Summary

Like other large corporations, Ford Motor Company has many individual business systems. Over the years, engineering, manufacturing, purchasing, and marketing organizations have created mission-critical environments that provide information for managing their functional operations. Beginning in 1999, Ford came to realize that it would substantially improve its internal operations by organizing access to enterprise information according to inter-departmental business processes.

Ford launched the enterprise Product Information Management (ePIM) initiative in 1999. This initiative seeks to create an enterprise-wide infrastructure for rapidly integrating information from existing business systems. Based on an enterprise application integration (EAI) architecture, ePIM combines a business object rules-based engine with an extensible set of connectors. IBM's WebSphere Application Server and MQSeries messaging bus enable the integration of disparate enterprise applications.

Organizing information access around business processes yields substantial benefits. Rather than querying multiple systems to complete specific tasks, Ford employees in product engineering, manufacturing engineering, and purchasing functions can rapidly find the information they need through Web-centric inter-departmental information portals. Ford estimates that, for an investment in the millions of dollars, it now realizes tens of millions of dollars of process improvements.

THE BUSINESS CASE FOR AN ENTERPRISE APPLICATION INTEGRATION

Connecting Individual Business Systems

Like other large corporations, Ford Motor Company has many individual business systems. Over the years, engineering, manufacturing, purchasing, and marketing organizations have created mission-critical environments that provide information for managing their functional operations. For instance, engineering has various systems to manage the design of individual parts. Manufacturing uses a process planning system to track the tooling required to produce a new part. Purchasing has a third set of systems for issuing purchase orders for new machines. But when Ford needs to send suppliers the necessary information in order to bid on the machines for manufacturing a newly designed automotive part, a purchasing manager has to compile information from several separate systems. The end result is often costly time delays and the distribution of inaccurate or out-of-date information.

In 1999, Ting Liu, a project manager in Ford's Advanced Manufacturing Technology Center, began to investigate the business and technology strategies for connecting many of the company's independent business systems around critical sets of business processes. For instance, an external supplier should be able to

query a single environment to find all the information he needs for bidding on a new manufacturing tool. Working with a cross-disciplinary team from engineering and manufacturing organizations, Ting sought to identify the business opportunities for substantially improving product and manufacturing engineering activities within the company.

Mapping Process Information Flows

The interdisciplinary team analyzed the kinds of information required to produce vehicles at Ford. They determined that many different IT systems used for manufacturing and product development needed to be integrated with one another.

The team mapped the current process information flows against Ford's product development process. In so doing, they identified the information people needed in order to complete various manufacturing or engineering activities as well as which systems managed the required data elements.

Business Requirements for ePIM

The interdisciplinary team concluded that Ford should embark upon an enterprise application integration (EAI) initiative to support seamless information flows among discrete engineering and manufacturing systems. Rather than build yet-another-generation of business applications, Ford needed to focus on the interoperability of existing applications and their associated enterprise data repositories. The user community at Ford and among Ford's network of suppliers and business partners needed to access a wide range of existing data assets quickly and easily. Ford could readily benefit from the successive generations of enterprise integration technologies, where it was now possible to integrate disparate systems through common middleware capabilities.

As a result of their analysis, the interdisciplinary team proposed that Ford should launch the enterprise Product Information Management (ePIM) initiative. This initiative would create an enterprise-wide architecture for rapidly integrating information from existing business systems, together with a technical strategy for reusing system components across multiple information sources. ePIM would substantially enhance business processes related to manufacturing and engineering activities by linking information with operational tasks and by improving the simplicity of the user interface for accessing disparate systems. End users would have the choice of using the native application screens or a Web-oriented, portal-based interface to find the information they needed.

IBM Solutions and Technologies

SOLUTION: This case study describes a major e-business initiative that transforms internal operations by integrating disparate enterprise applications and processes into a consistent, portal-oriented environment. Ford engineers and purchasing managers can now find essential information associated with their business tasks through a single portal rather than having to access multiple business systems and databases.

SOFTWARE: WebSphere Application Server V3.5 is used as the underlying application integration server, together with MQSeries for managing the messaging queues that interconnect disparate enterprise applications.

BUSINESS BENEFITS: The ePIM initiative within Ford supports inter-departmental process information flows. Using common middleware, existing enterprise applications automatically exchange information as needed, and people can query multiple enterprise databases through a single request. As a result, people and applications can readily locate and manage information from disparate sources according to their own work tasks and business activities.

Quantifying the Business Benefits

In addition, the team quantified the business benefits for improving the process information flows by integrating engineering and manufacturing operational systems. They calculated the costs of performing critical processes without information sharing capabilities and then the benefits of redesigning the process based on specific improvements. They estimated that, for an investment in the millions of dollars, Ford would realize tens of millions of dollars of process improvements.

With this kind of business justification, Ford issued an RFP, and began the design and development of the ePIM initiative, in October 1999. (The overall timeline for ePIM is shown in Illustration 1.)

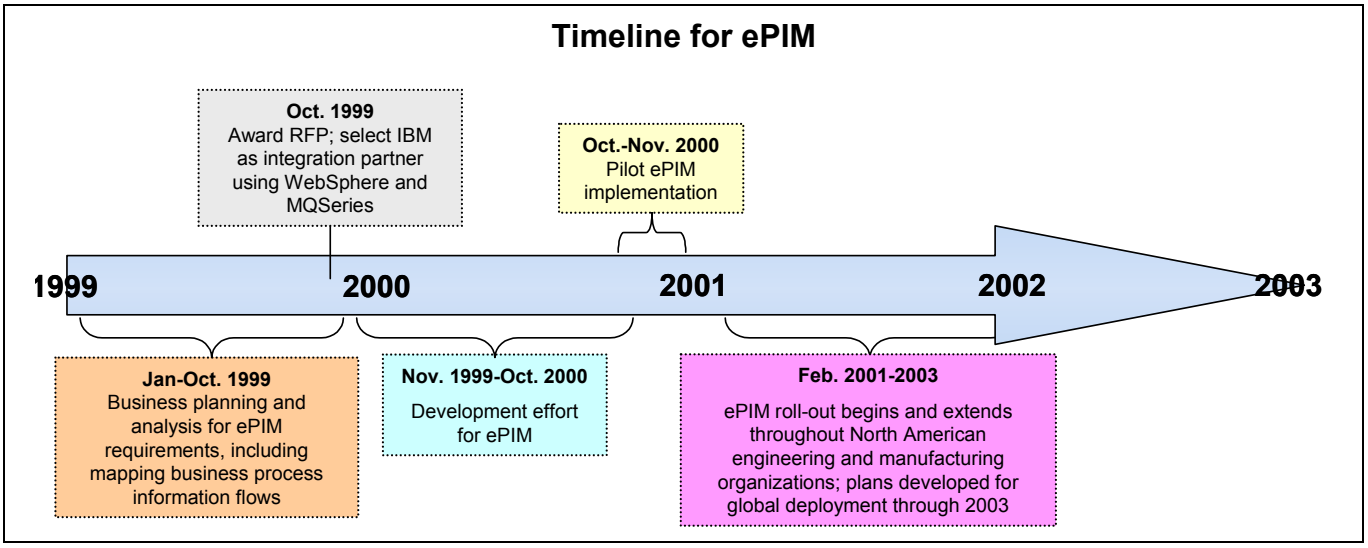

Illustration 1. ePIM began in early 1999 with an intensive analysis and business process mapping effort. The actual implementation of the underlying technology began at the end of that year and continued throughout 2000. Following a pilot implementation in October-November 2000, Ford began to roll-out access to the ePIM environment in February and March 2001. The roll-out continues and plans are now in place to integrate additional enterprise applications on a global level over the next 24 months.

DESIGNING AND DEPLOYING ePIM

Underlying Architecture

ePIM requires not only the interconnection of disparate enterprise applications, but also a high degree of data sharing for integrating business processes. Ford had already built a robust network environment where the company linked most of its enterprise systems together using Internet-related technologies, such as TCP/IP as the network protocol and HTTP for browser-based interactions. The company now needed to take the next step of automatically integrating the information maintained by one system with information managed by another. Moreover, ePIM sought to develop an extensible and scalable solution where people (or other automated processes) could retrieve required information from any enterprise application that is part of the environment.

The ePIM architecture is based on both common middleware and a business object rule-based engine, as shown in Illustration 2.

The ePIM architecture focuses on a common set of middleware infrastructure components. These components facilitate access to and the synchronization of information among multiple existing enterprise applications and their underlying databases. The ePIM architecture also focuses on the presentation of results to end-user interfaces.

Three Layers

As shown in Illustration 3, there are three layers to the logical view of the ePIM architecture: the ePIM Presentation Layer, the ePIM Connector Layer, and the ePIM Integration Layer.

1. The ePIM Presentation Layer provides a user interface, together with a portal application, for organizing the access to the underlying content repositories.

2. The ePIM Connector Layer extracts the application-specific logic for providing access to discrete systems and databases. As a result, ePIM is agnostic about the underlying platform. Existing enterprise applications run on many different hardware/software platforms including the IBM S/390 Parallel Enterprise Servers and other platforms.

3. In between these two layers, the ePIM Integration Layer uses an integration server and a message broker to link information requests (and responses) from the Web server to the designated connectors, and then to return the results. A key component of the Integration Layer is the Business Object Rules-based En-

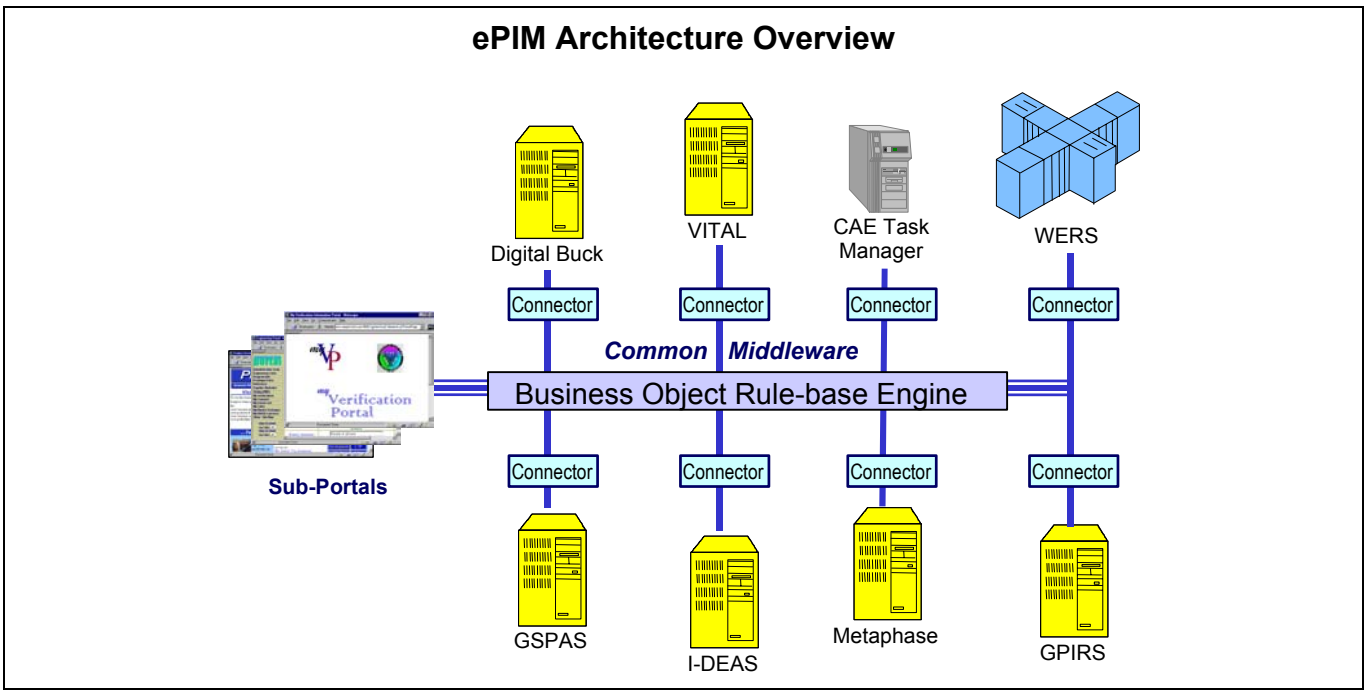

Illustration 2. The ePIM architecture relies on a common middleware layer, a business object rules-based engine, and an extensible set of connectors. Each existing enterprise application uses its own connector to connect to the middleware layer and thus provide information to the portal.

gine. This engine establishes specific business rules—the common data definitions and operations—at a product-data level and thus facilitates the exchange of information among the enterprise applications and their associated data repositories.

Thus, the ePIM architecture identifies the technical standards required to support a wide array of commercial products and components.

Selecting WebSphere

After careful consideration of competing products from several vendors, Ford chose IBM's WebSphere Application Server as the integration server and IBM's MQSeries as the underlying message broker.

Ford's selections were based on two factors: state-of-the-art technology and company viability. Corporate technologists were looking for a solution from a major corporation, one that emphasized a high degree of compliance with the J2EE specification. IBM's ongoing support for Web services and continued investments in WebSphere demonstrated its commitment to the Web application server marketplace.

As Fredrick Bsharah, the ePIM architect, observes, "WebSphere is the brain in the central nervous system for knowing where all the data resides and how to access them."

WebSphere and MQSeries in Operation

Business Enablers and Business Rules

The ePIM architecture depends upon sets of Ford Business Enablers (FBEs) and Ford Business Objects (FBOs). The FBE/FBOs depict the logical enterprise information architecture for Ford's Product Development and Manufacturing Engineering environments.

FBES. FBEs are Enterprise Java Beans that define how to obtain the right data from the right system based on the particular type of data required by the application. FBEs are responsible for data associated with a specific business construct, such as a product definition or a change management process. Each FBE consists of a set of Java classes called FBOs.

FBOS. FBOs encapsulate entities such as parts, people, notices, and documents. They are implemented as Java classes, where the schema and connection information

required to extract data from legacy systems is modeled based on an enterprise-wide mapping table. FBOs define both specific things and business processes.

Using Message-Oriented Middleware

The ePIM initiative uses message-oriented middleware to invoke the objects and enablers within the rules-based engine.

As the underlying integration server, WebSphere fulfills a critical role within the overall architecture. It serves as the process-driven rules engine for managing all of the FBEs and FBOs within the ePIM environment.

Specifically, ePIM supports two critical kinds of enterprise information requests: request/reply and publish/subscribe.

REQUEST/REPLY. When one person or automated process wants to find information that is stored on various systems within the ePIM environment, the person or process makes a direct request to the WebSphere server in the form of a query based upon the logical enterprise architecture. WebSphere maintains a comprehensive knowledgebase about all the defined FBEs and corresponding FBOs. It serves as the container for storing the FBE/FBOs.

For example, if a manufacturing engineer wants to review the latest visualization geometry and tooling information for a new part, the engineer makes a single request from his/her Web browser. This request generates queries to both underlying applications and returns a set of replies that are presented on a single screen display. In the past, the engineer had to log into two separate applications and query two separate databases to find the information he/she needed.

Behind the scene and transparent to this manufacturing engineer, WebSphere utilizes the FBE/FBO architecture to translate logical requests into physical calls to the individual legacy applications/databases. The replies are then translated back into logical data sets that are presented back to the requester. In effect, WebSphere does the data hunting and presents the results to the requesting party in near-realtime. There is obviously some latency involved, due to various design parameters for accessing specific systems.

PUBLISH/SUBSCRIBE. Publish/subscribe is comparable to request/reply, with one important difference: it supports asynchronous messaging and communications to facilitate the synchronization of two or more databases through the use of guaranteed message delivery. MQSeries provides a messaging broker component that allows the provider of information to be decoupled from the consumers of that information. ePIM thus removes the need for an application to know the specific data structures and access methods for the target application. Instead, an application simply sends the information it wants to share to the messaging broker which, in turn, is responsible for handling the subsequent distribution of the information.

Thus, when one person performs a save on a particular record in an application, the application notifies the messaging broker. Other systems that have indicated their interest in the updated information then receive an asynchronously-generated message to retrieve the updates. The receiving application then synchronizes the information as an update process.

Publish/subscribe activities are tied into routine business processes. For example, when a design engineer changes the quantity of some component in an assembly, he or she updates the "parts list" information in an engineering database that is responsible for managing bills of materials. When a purchasing manager in manufacturing goes to order the total number of components for a vehicle, he or she checks a procurement system. Without ePIM, the procurement system has no knowledge of the changes the engineer made to the bill of materials. Using the publish/subscribe capability, the application managing the bills of materials within the product engineering organization "publishes" the update occurrence to ePIM. The procurement system within manufacturing subscribes to the update.

Consequences and Benefits

As a result, ePIM supports automated information flows among disparate enterprise business processes. Ford continues to maintain its existing IT infrastructure, organized around task-specific enterprise applications. Using WebSphere and MQSeries for the ePIM integration layer, Ford is now able to enhance and extend the capabilities of these enterprise applications and organize information flows relating to inter-departmental process maps.

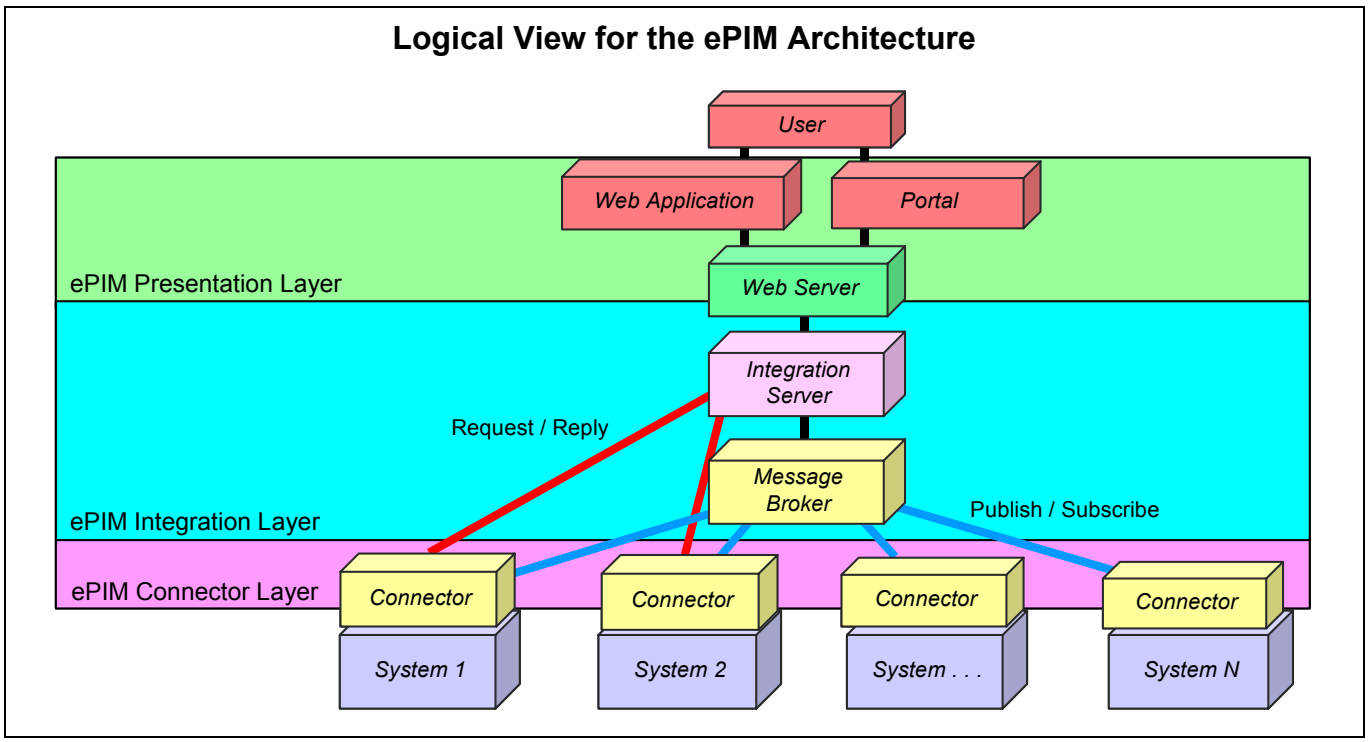

Illustration 3. There are three layers to the logical view of the ePIM architecture: the ePIM Presentation Layer, the ePIM Integration Layer, and the ePIM Connector Layer.

ePIM IN OPERATION

Rapid Deployment and Expansion

Following a year-long development effort, Ford launched its integrated information environment, based on the ePIM architecture.

Ford first created a pilot environment in October-November 2000, and then rolled out access to ePIM throughout North American engineering and manufacturing divisions in February and March 2001. Six EAI pilots connecting numerous enterprise applications are in a full-scale production environment. Ford has plans in place to integrate additional enterprise systems. In addition, over the next two years, the Ford IT organization expects to roll-out ePIM on a global level.

A State Three e-business Environment

ePIM is thus a State Three e-business environment, as shown in Illustration 4. ePIM focuses primarily on expanding internal integration processes. In addition, it is beginning to incorporate selected Ford suppliers and other third parties who have registered access to the Ford network.

We believe that ePIM will evolve into a State Four environment over the next few years. The key factor is creating and maintaining a robust, scalable EAI environment.

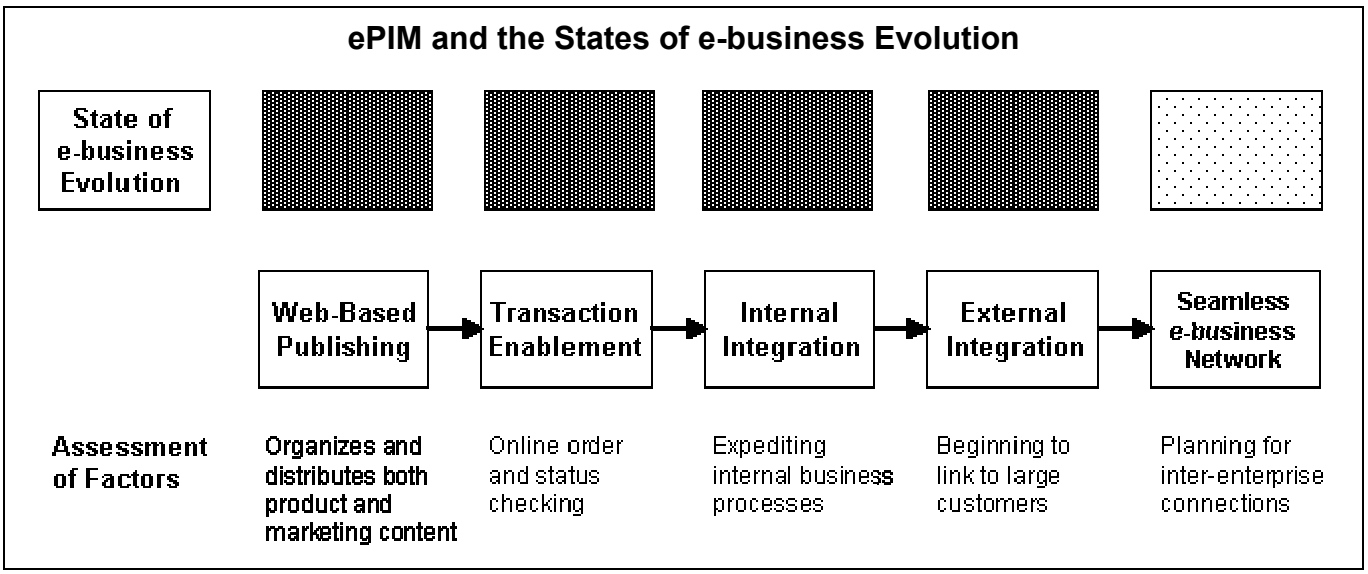

Illustration 4. ePIM integrates information from disparate enterprise applications according to business process information flows. ePIM is thus a good example of a State Three, Internal Integration environment that expedites internal business processes. In addition, ePIM provides the foundations for State Four, External Integration, when suppliers and other trusted third parties can link to specific, partner-facing business processes.

An Emerging Global Infrastructure

Finally, ePIM demonstrates the business benefits of WebSphere and MQSeries in a multinational environment.

Ford, in fact, has decided to utilize these two products as key components of its emerging IT infrastructure because it was looking for an appropriate solution from a major technology partner. IBM's ongoing support for Web services and its continued investments in WebSphere-related enhancements were key factors behind Ford's decision to build its EAI technology strategy on these two product families.

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