

IMS

THEN and TODAY

IBM's Information Management System (IMS) is still one of the most popular OnLine Transaction Processing (OLTP) systems in the world with more than 50 billion transactions running through IMS databases each day. The latest version, IMS 10, was recently released so now's a good time for customers and IBMers to revisit IMS – which comprises both a transaction monitor system and a hierarchical database management – and what makes it special.

IMS - THEN and TODAY

IMS continues to be an important component of modern world wide computing having a strong heritage in 95% of Fortune 1000 companies. IMS manages over 15 million gigabytes of Production data serving over 200 million users processing on average 22,000 transactions per second on a daily basis.

IMS provides technological leadership to communicate with a network incorporating input/output messaging through a form of message queuing, message formatting, logging and recovery. It also implements the scheduling, execution, checkpoint / restart of online and batch messages from its processing programs.

How did IMS reach this esteemed acclamation from world wide use?

How it was started

In 1966, IBM along with the collaboration of two partners began the design for a new database called Information Control System (ICS) and Data Language/Interface (DL/I). Its objective was to handle an extremely large Bill of Materials (BOM) plan. BOMs are hierarchical in nature with the top level representing the final assembly or product. This design began the concept of database management systems. The IBM Team completed and shipped the first release of ICS in 1967. The following year, ICS was installed and the first "READY" message appeared on a typewriter terminal at the Rockwell Space Division at NASA for the Apollo moon mission. In 1969, ICS was renamed to Information Management System/360 (IMS/360) becoming available world wide.

The importance of this design was the model of separating application code from the data which was and is today's DL/I. IMS controls all access and recovery control of the data. This partitioning established a new paradigm for all application programming for the reason that application developers could now focus on the making use of information without the complication and overhead related with the access of data. This implementation also eliminated copies of data providing a centralized location introducing data-sharing. In addition to a new data base system, IBM developed an online component to support DL/I enabling access through terminal devices known as data communications (DC) which later evolved into the IMS Transaction Manager (TM).

IMS consists of three components:

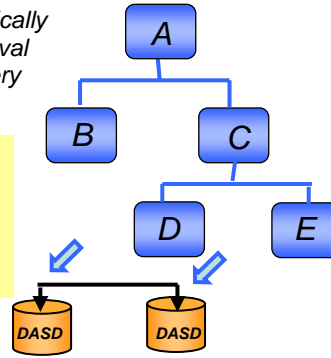
- The Database Manager (IMS DB)
- The Transaction Manager (IMS TM)
- The Common Services to IMS DB/DC

Known collectively as IMS DB/DC¹, the three components creates a complete online transaction processing environment that provides continuous availability and data integrity. IMS TM and IMS DB can be ordered and paid separately if the functions of one component are not required. The appropriate system services are provided for the component ordered. When IMS DB is ordered by itself, it is called DB control (DBCTL). When IMS TM is ordered by itself, it is called DC control (DCCTL).

¹ "DC" - Data Communications was used as a past acronym

IMS DB is organized hierarchically
- Optimizes storage and retrieval
- Ensures integrity and recovery

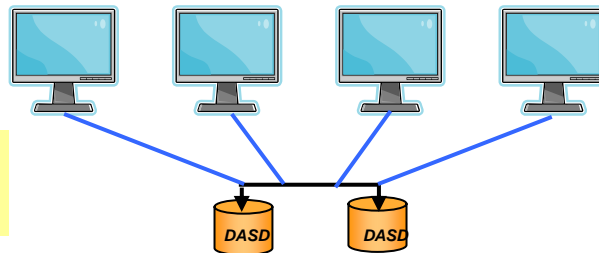
IMS DB records have predefined relationships providing for high speed data access



IMS Transaction Management(TM) system provides the industrial resources to communicate with the network, manages input/output processing and security. This component of the product provides message queuing, formatting services for different device types, transaction logging and recovery. Finally, it ensures the scheduling, execution, and checkpoint/restart of online and batch messages through its processing programs.

IMS TM provides support for advanced telecommunications

IMS TM brings together multiple products and protocols in a unified network



IMS architecture provides Open Transaction Manager Access (OTMA) which is an open interface to IMS TM allowing TCP/IP application programs to send transactions and commands to IMS without using IBM's proprietary network architecture SNA (System Network Architecture). Many programs can connect to IMS TM using OTMA such as middleware, gateway programs, and other databases.

NOTE: The OTMA interface is highly flexible.

Is IMS Strategic?

IMS continues to be a thriving and innovating database management system fulfilling important and essential roles in relation to many business requirements. IMS continually reinvents itself as new functional demands arrive on the IT scene.

In the last few years IMS systems have grown over 25%. Therefore overall, the growth of new IMS licenses remain positive, fueled largely by expansions due to today's economics with corporate consolidations. Having said this, this notes the fact customers display confidence in the future of IMS. As a past example, MIPS capacity of IMS increased 67% in the first few years of this decade. The ability of our IMS teams to deliver revenue growth is measured by our business success. Hence, the overall health of IMS is robust and has never been better, in its 38 year history. IMS is on its way to its third record breaking year in a row, as measured by the revenue delivered to IBM.

Who uses IMS

The top world wide companies in many industries use IMS to run their daily operations:

- Aerospace
- Banking
- Communications
- Finance
- Government
- Health Care
- Insurance
- Manufacturing
- Retailing
- Technology

Interestingly, IMS is not necessarily breaking new ground in new acquisitions, but has ensured the foundation of its customer base continues to exploit innovations in its functionality and in some cases faster than most popular relational systems.

IMS and the mainframe platform strengthens the vast majority of financial institutions world wide. The Banking industry alone in the far east may provide more growth in the next few years than the rest of the world has in the past decade. Combine that kind of regional growth, especially with IBM's System z9, it's no wonder why this collective solution provides a winning combination.

IMS Offerings

Now that we've established IMS' viability, even unmatched in database throughput, IMS offers a wide preference implementing new application design:

- Integration
- Open Standards
- Reliability
- Scalability
- Self-management
- Web serving
- XML processing
- Workload readiness for SOA
- Ownership value

IMS embraces an IMS Integration Suite. Existing IMS applications using IMS technology allows for connectivity, data representation, and enhanced application development. This allows existing investment in IMS skills to deploy IMS-based applications over the web without touching a single line of code providing access to IMS transactions and data from any web connection.

Alternatively, you can modernize IMS Applications and enable them to interoperate with other clients, such as Microsoft .NET or SAP clients and other IT Systems within an existing enterprise or supply chain. The IMS SOAP² Gateway is a Web service solution that integrates IMS assets in a Service-Oriented Architecture (SOA) environment. IMS SOAP Gateway enables IMS applications to inter-operate outside of the IMS environment through SOAP to provide and request services independent of the

² Simple Object Access Protocol

platform, environment, application language, or programming model. It assists enabling IMS applications to become a Web service.

IMS provides a robust interface to Java. The IMS JDBC Connector (formally called IMS Java application support), allows Java application programs to access IMS databases from a variety of popular subsystems inclusive of Distributed platforms. Hence, Java application programs can use JDBC to access IMS databases. JDBC is the SQL-based standard interface for data access in the Java 2 SDK Standard Edition and Enterprise Edition. The IMS implementation of JDBC supports a selected subset of the full facilities of the JDBC 2.0 API. This subset allows everything that traditional IMS applications do using DL/I calls. There is also a feature to allowing the IMS Java hierarchic database interface to lower-level access of IMS databases allowing system analysis / processing.

IMS has scalability through virtualization in assuring flexibility for growth and expansion. This works in a homogeneous environment utilizing many heterogeneous data and application resources with new hardware and software facilities to optimize performance, capacity, availability, and recovery. This includes new levels of enhanced availability for IMS High Availability Large Databases (HALDB)³ introduced in IMS V7, with fully integrated Online Reorganization support that provides concurrent online update and availability of data.

The IMS Transaction and Database Server is evolving to further strengthen its support for Enterprise and Network Computing environments. IMS has been providing increased capacity and incremental horizontal growth offering improved availability with network, message and data sharing. It utilizes the coupling facilities of the z platform and the latest technological advancements for security and integrity of z/OS. IMS has provided open/integrated access with Java and XML. IMS has also been providing improved systems management in automated operations, workload balancing, dynamic routing, dump analysis and packaging enhancements. Building on a tradition of success, IBM has been offering additional product and tools for IMS which enhance enterprise computing systems management, availability, and capacity. In addition, IBM is offering additional product and tool enhancements to simplify access to both legacy and new IMS applications and data.

Because XML and IMS databases are both hierarchical, IMS is a natural DBMS for managing XML documents. IMS will allow easy retrieval and storage of incoming XML documents. It can compose XML documents from existing legacy information and stored them in its databases.

For application and information integration as well as for operational integration, IMS is exploiting the latest programming technologies for the Internet and Java. With the industry standard, open interfaces of Java, users can transparently download and seamlessly run applications. It is becoming widely used and is platform independent. IMS applications and data can use and be accessible using the latest in standard architectures and interfaces, include the J2EE Connector Architecture (JCA) and standard application programming interfaces, for example, Java Database Connectivity (JDBC) interface, across platforms.

The J2C dynamic wizard in Rational Application Developer allows for the creation of specialized Java classes representing the input and output messages of an IMS transaction from the corresponding COBOL or C data structures of the IMS application program. These specialized Java classes are called data bindings.

³ HALDB is designed to increase the capacity and availability of full-function databases.

In conjunction with WebSphere studio tools and WebSphere servers, IMS' Integrated Connect/Connector for Java function can be used for new J2EE application development and enablement to access IMS applications. IMS provides Web services for IMS applications using the WebSphere Application Server, IMS Connector for Java, and IMS Connect.

Tools can transform existing IMS transactions into Web services by using the WebSphere suite of products to create service definitions for IMS transactions. You then deploy these service definitions to WebSphere Application Server (WAS) to make the IMS services available as Enterprise Java Bean (EJB) services or Simple Object Access Protocol (SOAP) services. In this way, users can enable IMS applications as Web Services to support IMS COBOL, C and MFS-based applications. This Web services support integrates IMS into the Services Oriented Architecture (SOA). SOA is key to interoperability and flexibility for on demand business. SOA supports end-to-end integration across the enterprise and among business partners. This provides a flexible business process model that allows customers to respond quickly to new customer requirements, new business opportunities, and competitive threats.

IMS Java support provides for the development/enablement of Java applications running under the IMS Transaction Manager and also for accessing IMS Databases with JDBC from applications running under other environments, such as WebSphere, CICS, and DB2 Stored procedures, as well. The IMS Java DB utility can help distributed as well as z/OS WebSphere environments access IMS data.

Interoperability is also being provided between Java, Cobol and PL/I applications, and between DB2 and IMS databases. IMS provides for the storage/retrieval of decomposed or intact XML data in IMS DB databases.

New support for DB2 Stored procedures can access IMS TM applications as well as IMS DB data. IBM provides JDBC access to IMS Databases with the DB2 Information Integrator Classic Federation product.

IBM is also planning to provide support for IMS Databases with XQuery⁴, the new standard XML interface. IMS is also using the WebSphere XML Adapter for COBOL and SOAP support with its IMS SOAP gateway code

The IMS SOAP Gateway is an XML based connectivity solution that enables existing or new IMS applications to communicate outside of the IMS environment using SOAP to provide and request services independently of platform, environment, application language, or programming model. The IMS SOAP Gateway enables the seamless exposure of IMS application assets as Web Services. The IMS SOAP Gateway, providing a relatively simple but extensible option, will provide the ability for non-WebSphere customers to re-use existing and to create new IMS based business logic. One typical usage scenario of providing Web services with the IMS SOAP Gateway is to enable Microsoft .NET client applications or intermediary servers that submit SOAP requests into IMS to drive business logic transactions. The SOAP for IMS function can assist organizations with Enterprise modernization, Application development, Business integration, and web services implementation.

⁴ xQuery is a query language designed to query collections of XML data. It is semantically similar to SQL. The best way to explain XQuery is to say that XQuery is to XML what SQL is to database tables. XQuery was designed to query XML data. XQuery is also known as XML Query.

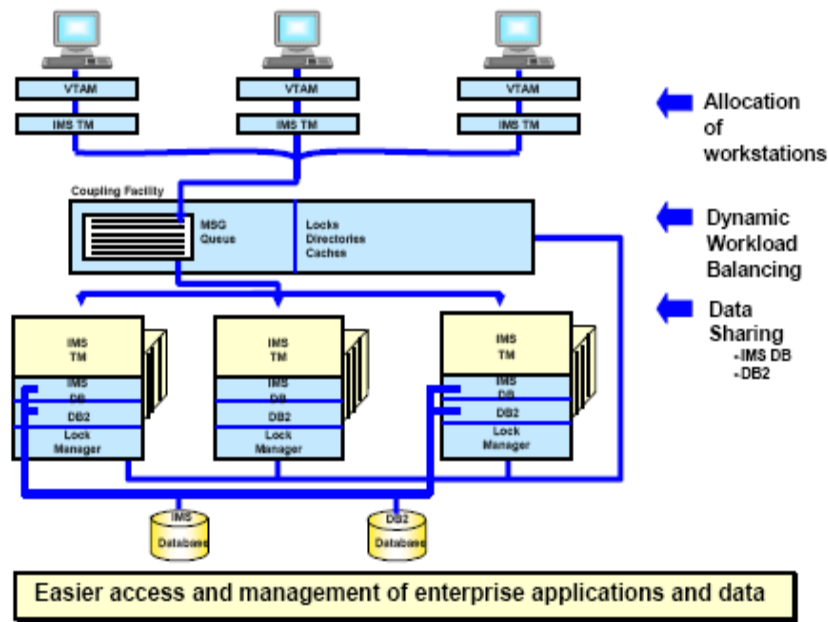
IMS in Parallel Sysplex

IMS continues to strengthen its support of the Enterprise by providing the highest in performance, availability, security, integrity, at the least cost per transaction. In doing this it has been exploiting the hardware/software environments that it has grown up along side of.

IMS fully exploits for the application advantage the new technology and power of z/OS and the Parallel Sysplex. Existing IMS data sharing capability was initially enhanced to take advantage of the coupling facility for storing lock information and for easy availability of that information by all systems in the Sysplex environment. The lock manager in each system could access the locks as they needed to. In addition to data sharing, IMS provided necessary information to the Z workload manager to assist with workload balancing of resources across the Sysplex.

IMS also enhanced message routing between systems to take advantage of workload balancing information, and IBM provided the IMS Workload Router to use these facilities to push the work to the available system. Significant enhancements were also added to complement the Parallel Sysplex hardware and operating systems facilities. IMS has since improved its initial Data Sharing and Workload manager enhancements with additional data sharing (storing changes and unaltered data on the coupling facility for Sysplex access, and providing additional Fast Path sharing), message sharing (providing message queues and fast path messages on the coupling facility for Sysplex access), and message routing enhancements (utilizing VTAM Generic resource support). As customer workload grows, the power of distributing data and applications across the Sysplex is needed. End users want to be able to access applications and data transparently, regardless where the work is processing. This enhanced support provides improved end user interaction, improved IMS availability, improved workload balancing, and offers increased capacity and growth in moving into Parallel Sysplex environments.

IMS in a Parallel Sysplex



Implementing IMS as multiple instances or in a Parallel Sysplex provides support of a Single Point of Operations Control (SPOC) presenting a single system image by allowing the user to enter commands to all IMSs in the IMS Sysplex (a.k.a. IMSplex) from a single console. Although designed with Sysplex in mind in order to optimize operations across a Sysplex, the new SPOC can also be used to improve systems management of commands in general, and the SPOC can be used to control any IMS, without the requirements of a Sysplex. This support can provide operations management for IMS DB and/or IMS TM environments from a TSO/ISPF Application running on z/OS or from a distributed DB2 with its IMS Control Center code.

IMS Easing Operations Manageability

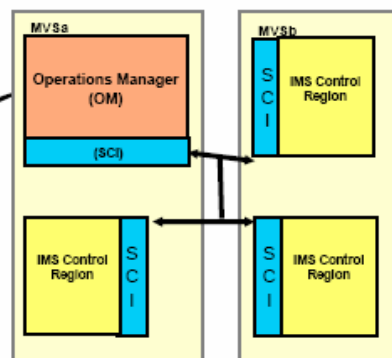
Operations Manager

- Routes Commands
- Provides an API
- Provides Single Point of Control and supporting code for entering commands



Single Point of Control (SPOC) can be used to control any IMS, with or without the presence of a Sysplex using

- TSO/ISPF Application, or
- DB2 V8 Control Center through IMS Connect to IMS



Ownership Value

The total cost of ownership is much more than software and hardware costs. IMS continues to work on a wide range of innovative means where customers have concerns.

The ability to scale as far as needed and using the processing capability efficiently continues to be a key concern. The cost of an outage can be tens of thousands of dollars per minute, so extending our traditional strength is crucial.

Many customers pay more for tools and utilities than for the base products. IMS is helping to provide better value for the money. Systems management is the key. Enhancements are being designed/delivered to ease IMS systems management and move toward Autonomic Computing.

Finding people with z/OS education and skills has become more and more difficult. IBM is not only are trying to ease use and management of the system to bring down the skill level requirements, but to also provide certification programs, training and working with universities to continue building up our skill base.

Hierarchical and Relational

Hierarchical and relational databases have grown up as separate data management solutions and provide different roles.

Hierarchical is best used for mission critical work and for that which requires the utmost in performance. Hierarchical data structure relationships are predefined having access paths distinct and ready to use by the application. Here careful design and known entity relations are an advanced requirement needed by the database administrator or analyst. Having an existing mapped out roadway to navigate data structures offers the ultimate in speed accessing data. In hierarchical, call structure syntax to access data can become complex.

Relational is best used for decision support and where application efficiency might be an unknown. This data is best used for engineering and scientific work where large, unstructured data is required. In this design, relationships of data structures are not known until runtime. Data elements are joined during database calls producing on-the-fly result sets for immediate analysis. The relational query syntax known as Structured Query Language(SQL) provides for a flexible means to form these database calls being an industry standard for the implementation of the relational model.

Therefore, one of the largest drawbacks of a relational database is its inability to initially handle queries efficiently. Because different portions of a transaction query can be stored in different structures, more work is required to gather that data when a query is performed. Using the Structured Query Language can incur high use of the machine's resources especially when complex data structures are required to form a result-set.

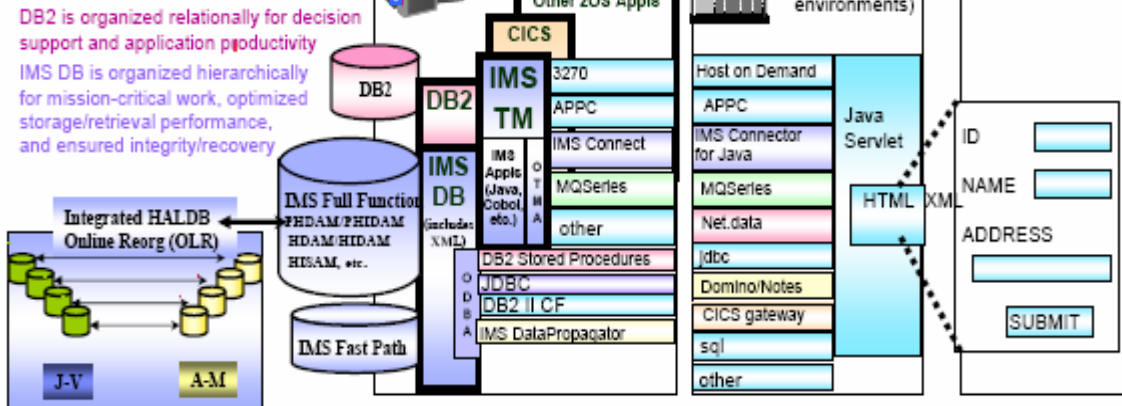
Although hierarchical can offer a significant performance edge over relational databases when queries are known beforehand, query 'optimization' for relational databases are better known, and have the edge in this area through disciplined administration practices. Each type is the best at what they do. The products supporting these are being enhanced to address the different application requirements and are continuing to create more and more overlap in their capabilities. The type originally designed for that capability will however inherently be the best at that. IBM will continue to invest in providing complementary solutions..

Relational databases do not usually suffer from the referential integrity problems that occur in hierarchical databases. However, relational databases are usually more complex in design than hierarchical databases. Specific relational design practices are used where by data elements and entities are 'normalized' to reduce data redundancy.

Relational and hierarchical technology can work together for optimum solutions. Users can efficiently store operational data in hierarchical form, which can be accessed easily by their favorite relational decision support tools, with minimal impact on the production hierarchical data. IMS data can be accessed directly or propagated and replicated with relational data for summarizing, enhancing, and mining. IBM provides standard application interfaces for accessing IMS as well as other data. Both relational and hierarchical IMS data can be most efficiently accessed, together or independently, using the IMS Transaction Manager and WebSphere servers.

IBM continues to invest in providing these complementary solutions.

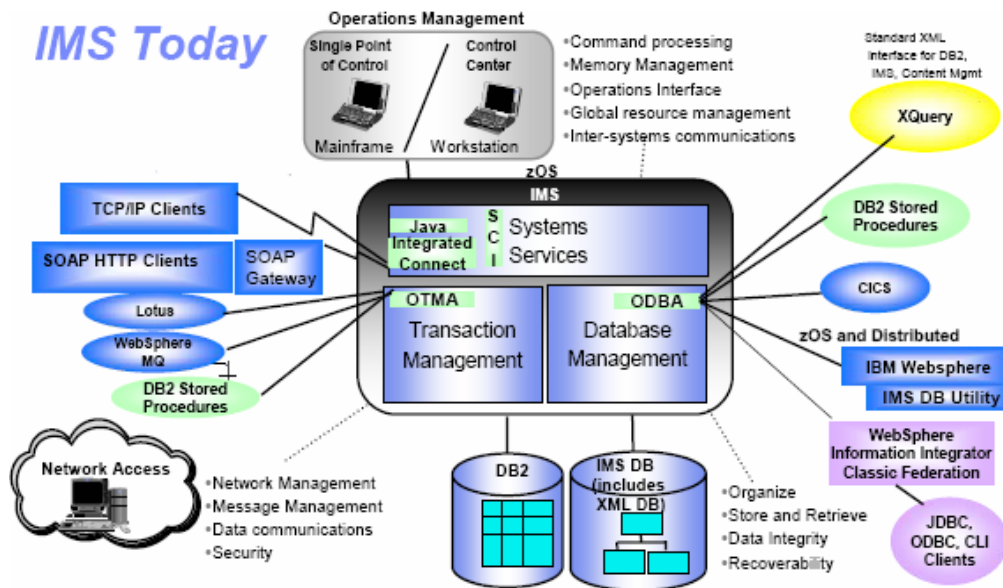
IMS and DB2



IMS Today

Since its inception, IMS has been at the forefront of technology in Database and Transaction Management. IMS has been the first at delivering IBM database solutions. Some other examples are: Multiple Systems Coupling Facility - IMS has been distributing workload across multiple systems for a long time, Datasharing - IMS has been the first to provide 2-way and then N-way data sharing, and extended that to Message sharing and network sharing as well. eXtended Recovery Facility (XRF) provides a hot standby capability for IMS customers. IMS is the only DB/TM system to provide this level of high availability takeover support. This is also true for Remote site Recovery.

IMS Today



IMS offers a highly integrated, open access with enhanced IMS/XML database support, XQuery access to IMS data, and broadened Java and XML tooling to ease development. It also provides System Manageability through staging users to autonomic computing with simplified dynamic resource definition, eased operations and systems management, integrated operations across subsystems/platforms, enhanced security and serviceability. It offers scalability with more parallelism in IMS Database Recovery and Sharing Control (DBRC), and improved performance/capacity in Fast Path⁵, IMS High Availability Large Database (HALDB), and database utilities. IMS scalability offers widened bandwidth for Multiple Systems Coupling, improved system availability, performance, and capacity in workload balancing.

IMS Fast Path continues to support the highest transaction per second database access solution. As we move further into the new era of computing, IMS is still leading the way. More than 30 years since the first IMS READY message for the Apollo Space program, IMS and Z are breaking technology barriers, but sometimes taken for granted. But IMS continues to lead the industry in performance, availability and on demand business enablement.

Summary

IMS is a powerful database and transaction management system, which also includes significant systems services that are built on and exploit the Z processors and its operating system architecture.

The IMS Database Manager can be used with applications running under the IMS Transaction Manager, CICS Transaction Server, or running as DB2 stored procedures, WebSphere EJBs, etc.

The IMS Transaction Manager can be used with IMS DB or DB2 data. Along with the IMS Transaction and Database Managers are IMS Systems Services, consisting of facilities to optimize/ease systems operations and management. These services help with command processing, memory management, operations interfaces, global resource management, and inter-systems communications. These services also include support for industry standard, Java application support for IMS transactions, Java data base connectivity to IMS and DB2 databases, and interoperability with existing IMS applications and data. These services also included integrated connect function, which provides for open connectivity support to IMS applications and operations.

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⁵ IMS FAST PATH is a specially designed database for very intensive performance of application transactions. It was first introduced in Retail Banking.