Information Management for System z

IMS *- Information Management System*
- Transaction Monitor Part -

Thilo Liedloff

Technical Sales / IT-Specialist IMS

18.09.2009

What is IMS ?

YOU are maybe using it daily...

...without knowing it.

IMS Myths

Some sentences you may hear sometimes about IMS

„IMS ...

- ... is old fashioned.“
- ... is not used anymore.“
- ... DB is hierarchical, which is not state of the art.“
- ... will die in the next 5 years.“
- ... is not developed anymore.“
- ... is not performing.“
- ... is to expensive.“

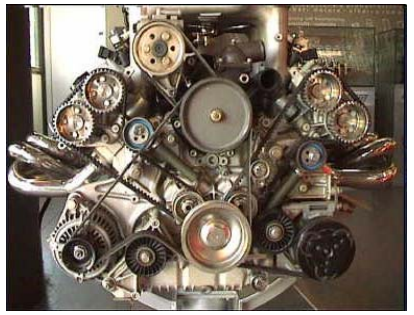
But … is this the truth ?

IMS 41 years anniversary

- In 1885, Gottlieb Daimler invented what is often recognized as the prototype of the modern internal combustion engine

- Today – 124 years later - most road transport is still powered by the internal combustion engine

- But there is no way that you'd refer to a Ferrari engine, for example, as "old fashioned"



- IMS is just 41 years old. At the basic level, its design today is unchanged from what is was in 1968. But the actual implementation has evolved with technological advances, and always provides state-of-the-art transaction and data serving

IMS is constantly being renewed to meet tomorrow's demands

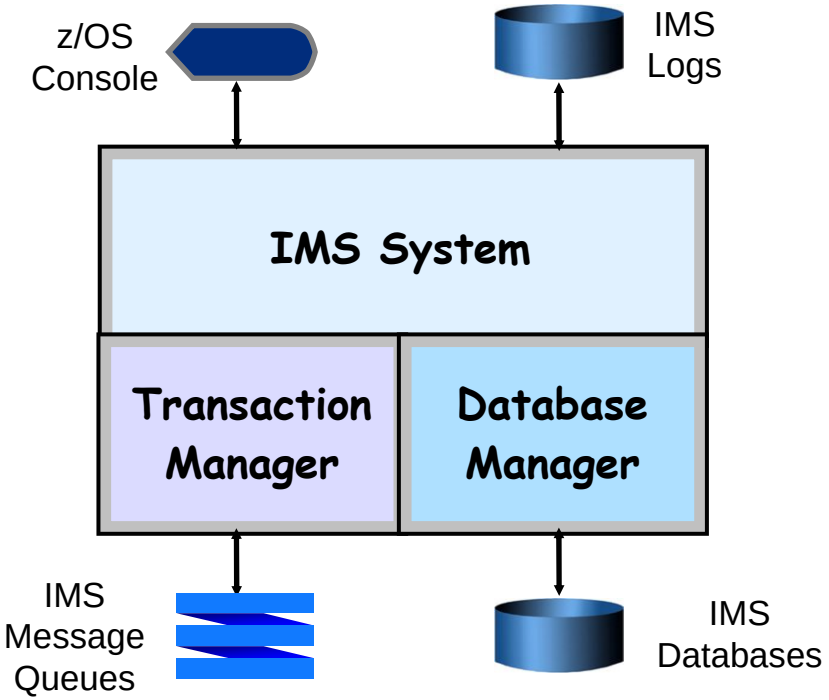
IMS Early History

- It was designed and written jointly by IBM and Rockwell in the mid to late 1960s
  - IMS/360 announced in 1968
- Objective was to provide an accessible repository for storing information about the several million parts that were used to make a Saturn V rocket
  - Part of Apollo Lunar Space Mission
- The Saturn V Parts Database was inherently hierarchical (components made of assemblies made from …. made from elemental parts)
  - So IMS databases are Hierarchical DBs

What is IMS ?

- **Transaction Monitor (DC)**
  - Provides **high-volume**, **rapid response** transaction processing
    - Manages input and output messages from **network** (3270s, TCP/IP, WebSphere MQ, etc.)
    - Manages applications (**dispatching** work, **loading** application, providing **locking** services)
    - Manages application access to IMS and/or DB2 databases
  - Manages "**batch**" applications

- **Database Management System (DB)**
  - IMS Databases are **hierarchical**
    - **Faster** than relational databases
    - For high volume processing
  - Multiple database types
    - Full Function
    - Fast Path
    - High Availability Large Database (HALDB)
    - XML Database



Who uses IMS ?

IMS is mostly used in

- Banking
- Insurance
- Telecommunication
- Automotive

Because of the need for

- High volume
- High speed
- Reliability

IMS Facts

Most Corporate Data is Managed by IMS

- Over 95% of Fortune 1000 Companies use IMS
- IMS Manages over 20 Petabytes of Production Data
- 2.5 Trillion $ transferred through IMS daily

Over 50 Billion Transactions a Day run through IMS

- IMS Serves Close to 200 Million Users a Day
- Over 100 Million IMS Trans/Day Handled by One Customer
- 7M per hour handled by another customer
- 21,000 Trans/sec (near 1 Billion/day) with IMS Data/Queued sharing on a single processor with database updates (on a z9)
- Approx. 40.000 Trans/sec on a z10 processor

Over 3 million MIPS running IMS

IMS Version

- Normally every 2 year cycle a new release is GA.
- Currently is IMS Version 10 the latest Version since October 2007.
- IMS Version 11 is currently in Testing
- IMS V-next is already on the draw board
- IMS allows version skipping (e.g. IMS V8 to V10)

Transaction Manager Part

Why do you need a Transaction Monitor ?

A Transaction Monitor is like a framework for transactional applications

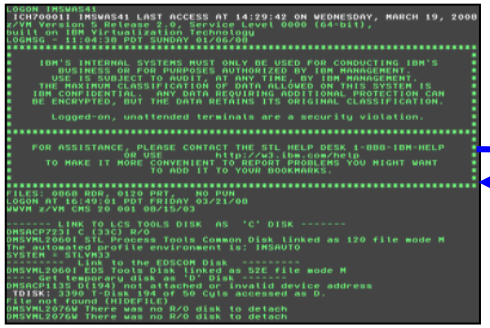
- It is responsible for loading and managing applications **(App. Management)**
- It manages the parallel processing of applications **(Deadlock handling)**
- It is responsible for access security **(Authentication & authorization)**
- It ensures Service Level Agreements **(Scalability & Loadbalancing)**
- It ensures durability **(Logging & redundancy)**
- It cares for the communication **(Interfaces & Transactionallity)**

A Transaction Monitor is not the same as a Transaction Manager in Java sense.

It Does more, but it also follows the ACID principles to ensure transactionallity.

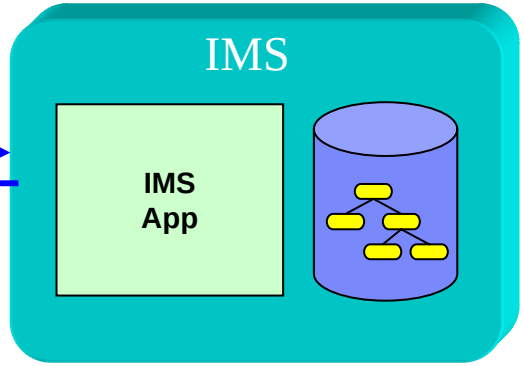
IMS Evolution

Earlier in history

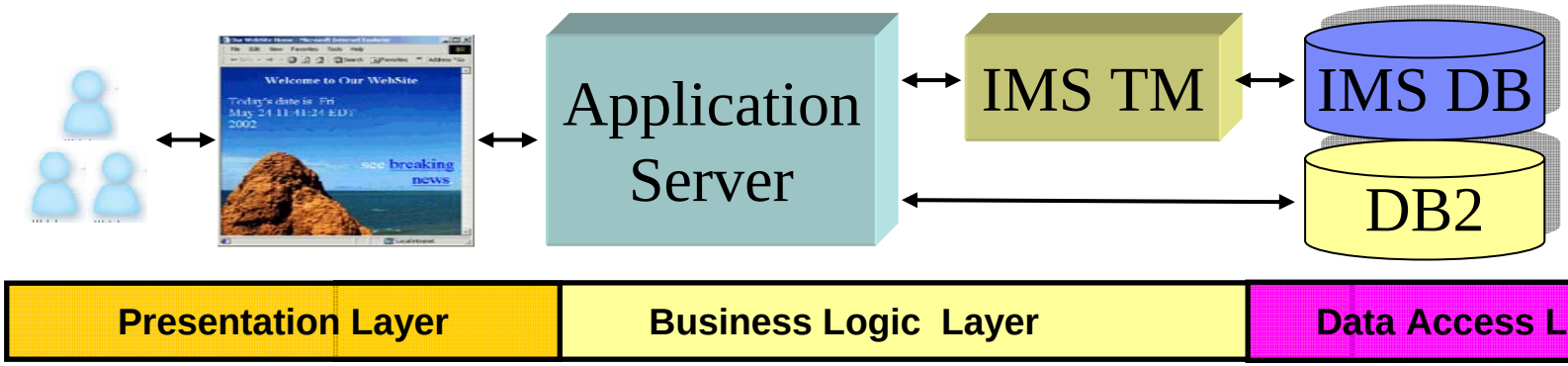


IVTNO DISPLAY LAST1

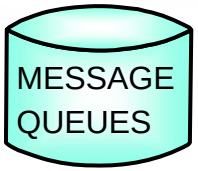
ENTRY WAS DISPLAYED
DISPLAY
LAST1 FIRST1
8-111-11111
D01/R01 0001



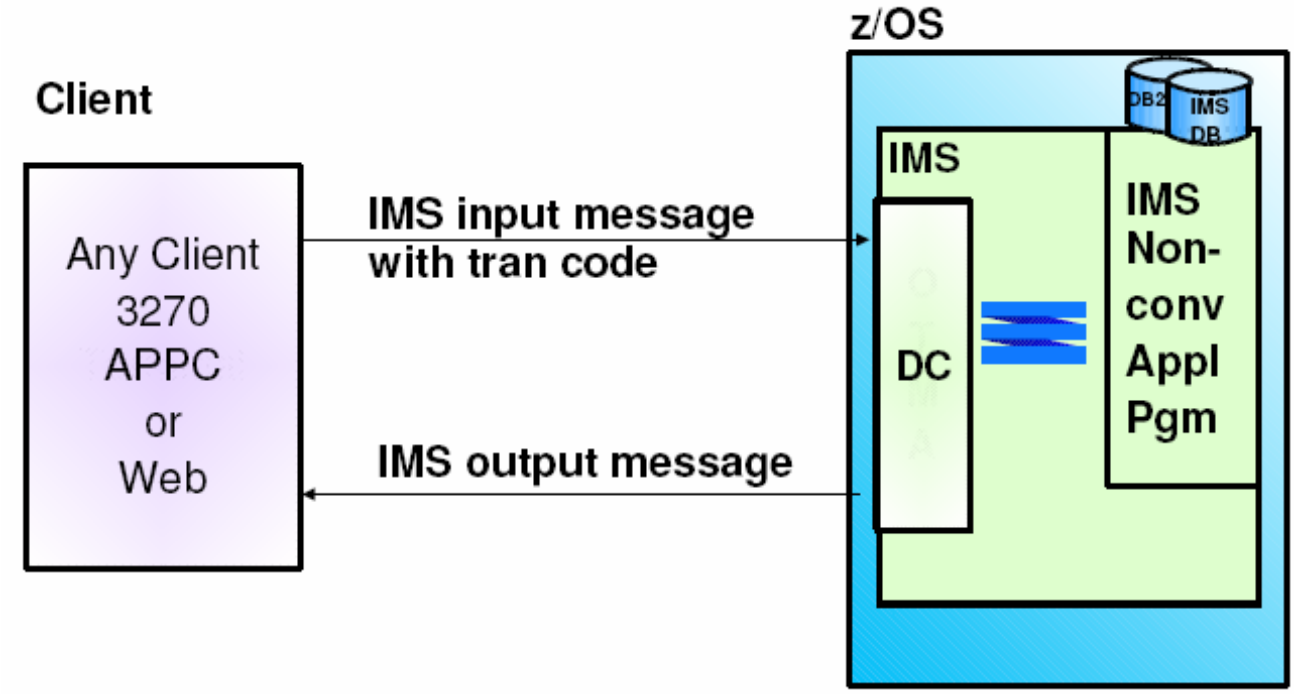
Today



IMS Messages



- IMS Transactions are Programs with a certain **Transaction code** assigned
- The Transaction needs an **input message** and creates a **response message**
- IMS TM has an input and and output **message queue**
- **All messages are logged** to make them recoverable

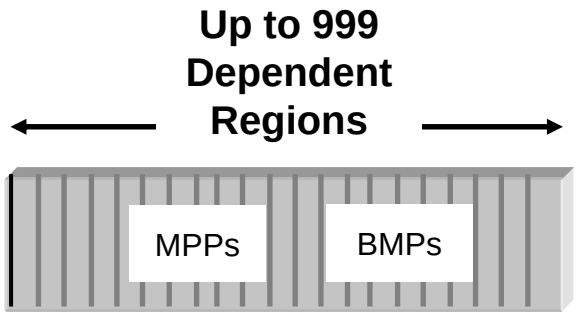


IMS Regions

Specific containers for sheduling messages and executing programs

There are different region types

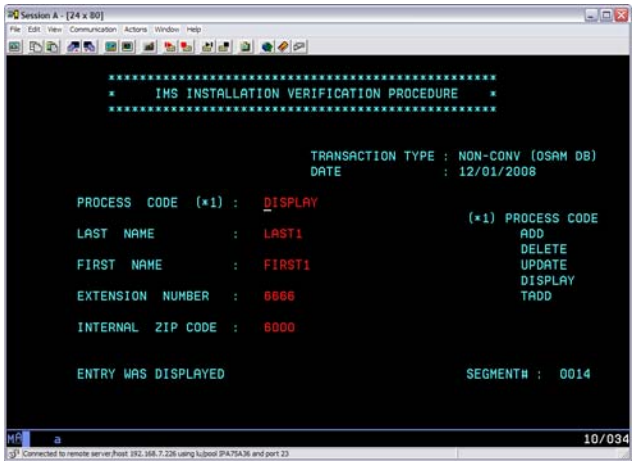
- **Language Runtime** specific
  - **MPPs** – Message Processing Regions for COBOL / PL/1 etc
  - **JMPs** – Java Message Processing Region for Java
  - **BMPs** – Batch Processing Regions
  - **EMH** – Fast Path Transaction Region
- **Characteristic** specific (i.e. High priority applications dedicated to certain regions)
- **Program** specific
  - Online Processing
  - Batch Processing
  - Wait-for-Input
  - Fast Path Regions

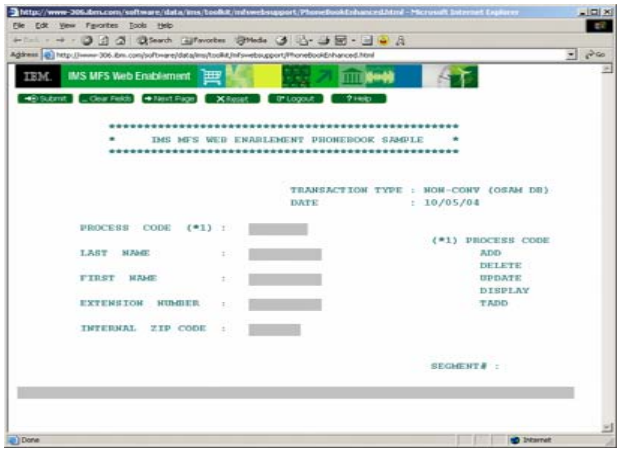


Basicly more Regions can handle more workload parallel at the same time

IMS Programs

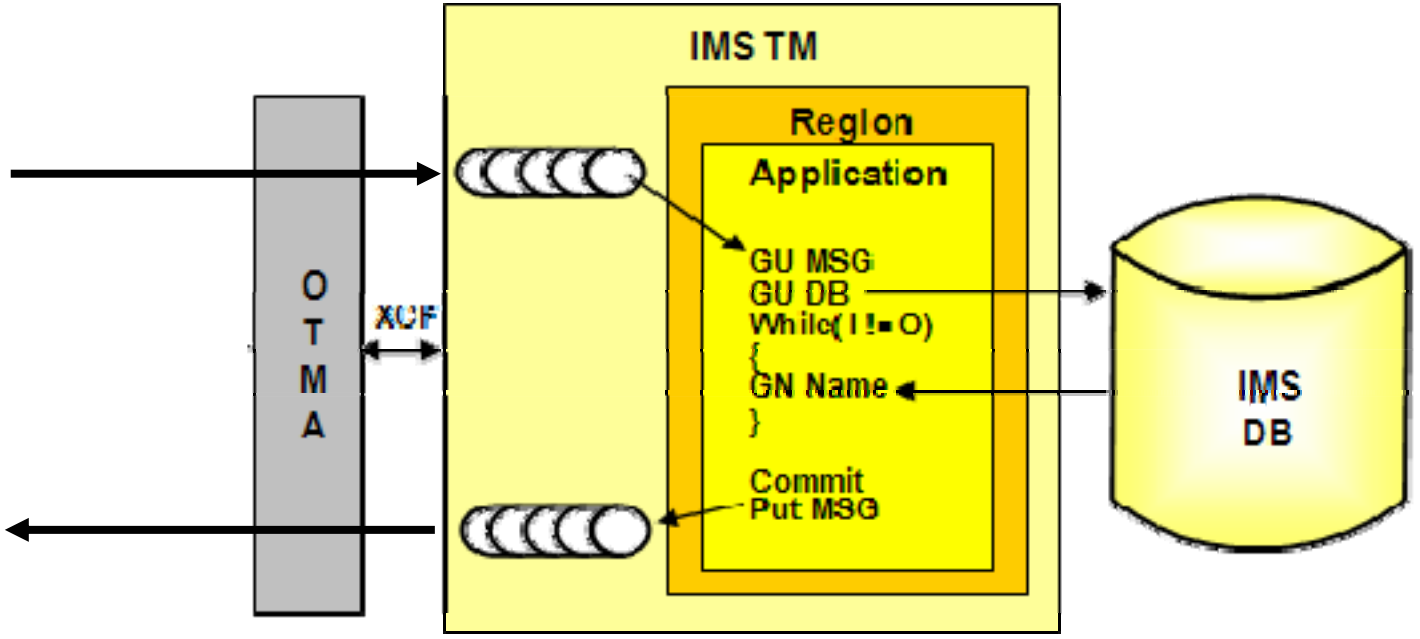
- Supported Program languages are
  - **Assembler**
  - **C**
  - **COBOL**
  - **FORTRAN**
  - **Java**
  - **PASCAL**
  - **PL/1**
- Transaction application programs are Input Device Independent **(SNA,MQ, TCP/IP,WAS)**





IMS Message Flow

1. A message flows from the Terminal into the IMS Input Queue
2. IMS loads the corresponding Transaction Program in the correct Region
3. The Program processes the message and issues the Database Calls
4. The Program commits the Transaction and the database changes
5. A response message is created on the Output Queue and flows back to the Terminal



IMS Batch

Batch Message Processing Programs are typically updating typically large amounts of data.

- Billing at the end of a month
- Salary increase for all employees
- Price changes on tax changes

- **Stand-Alone Batch Programs**
  - Has exclusive use of its own DBs (no sharing and no locking)
  - Does not need to take restart checkpoints and writes its own log
  - If it abends, manual recovery procedures must be followed
    - Backout incomplete sets of updates
    - Rerun from beginning or, if taking checkpoints, restart from last checkpoint
- **BMPs**
  - Share DBs with all other online programs
  - Share the IMS system log and must issue regular checkpoint calls
  - Will be backed out by IMS system if needs be, and any locks will be released
  - Always restarted from last checkpoint

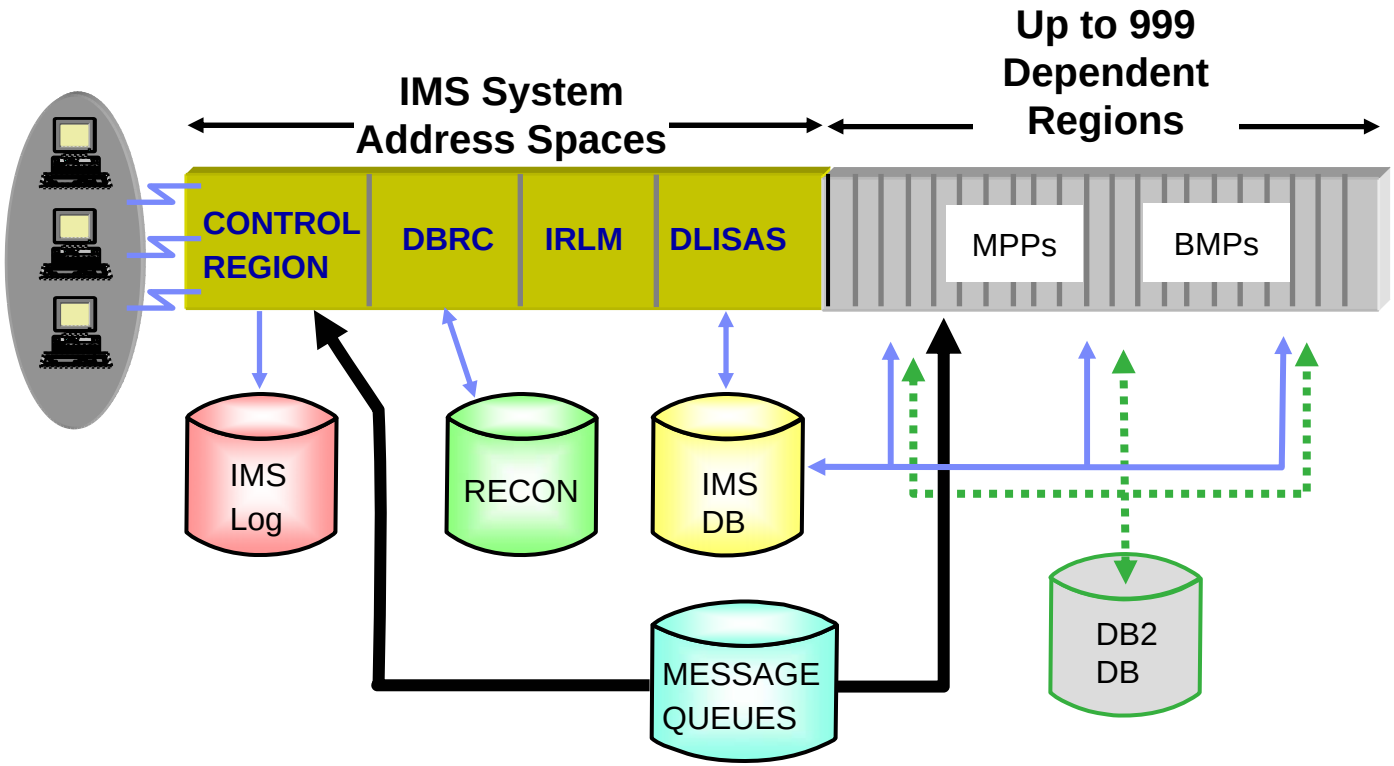
BMPs

Fast Path

- In the late 1970s, IMS banking customers were demanding DBs that could be partitioned to hold much greater amounts of data, that offered higher availability, and that made high volume data entry more feasible
  - **The result was "Data Entry Data Base (DEDB)"**
- Additionally, the banks were demanding even better performance for transaction processing where typically there are very heavy volumes but with relatively few different application programs
  - **The result was "Expedited Message Handling (EMH)" regions**
- These features are generically referred to as **IMS Fastpath**

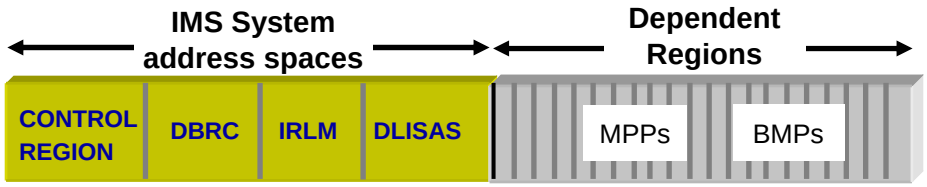
IMS Transaction Manager Architecture

IMS follows the **concept of separation** and has therefore multiple system address spaces for the different tasks (component model)



IMS System Address Spaces

- **Control Region**
  - The overall master address space, which manages –
    - Communication
    - Messages Queues
    - Message Format Services
    - Logging
    - Application Scheduling
    - IMS System Checkpointing
    - Transaction and Command Security
    - Operator command processing
- **IRLM**
  - Optional for a single IMS system, but mandatory in a data sharing environment
    - Provides lock management for IMS DBs
- **DLISAS** (DL/1 Separate Address Space)
  - Responsible for providing physical access to
    - Databases
    - Buffer pools
    - Control Blocks (DBDs)
- **DBRC** (DB Recovery Control)
  - Manages and records use of IMS logs
  - Tracks updating and housekeeping of IMS DBs
  - Manages sharing of DBs between different IMS subsystems, batch jobs, and utilities
  - Keeps its data in the Recovery Control Dataset (RECON)



High Availability

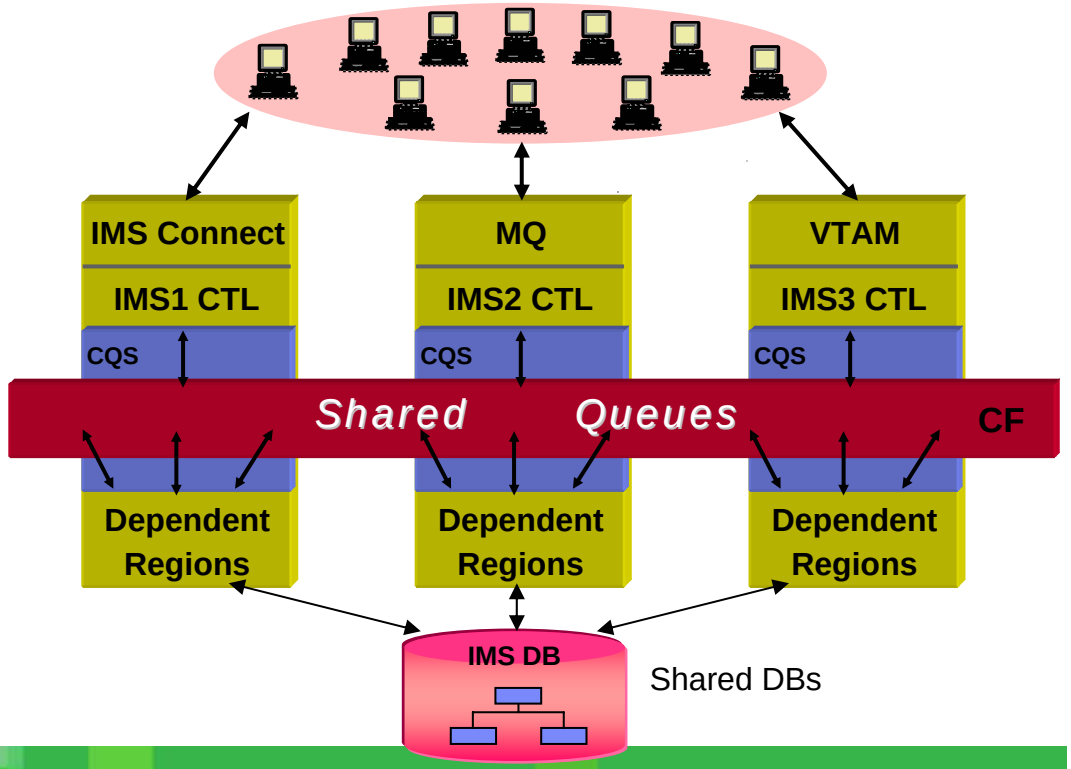
- **IMS systems provide high levels of robustness and availability**
  - Main issue is associated with Scheduled Outages
    - for new IMS release
    - software maintenance
    - hardware changes
  - Also unscheduled Outages like hardware error or disaster situations
  - Solution is **Queue Sharing** and many features for improved availability

- **The other key component of high availability is data availability**
  - IMS DBs can be kept online and in use while they are
    - Image copied
    - Reorganised
  - Also **Data Sharing** improves availability

IMSplex

- For availability, or sometimes capacity reasons, many large customers run multiple IMSs that share the workload
  - There are **Shared DBs** and **Shared Message Queues**
  - The complete set of deployed IMS subsystems and address spaces is called an **IMSplex**
  - IMSplex has the same principles as Sysplex, but could also be only on one system

- **Shared Queues Benefits**
  - Automatic load balancing
  - Very high system availability across unscheduled and scheduled IMS outages
  - Incremental growth and capacity management

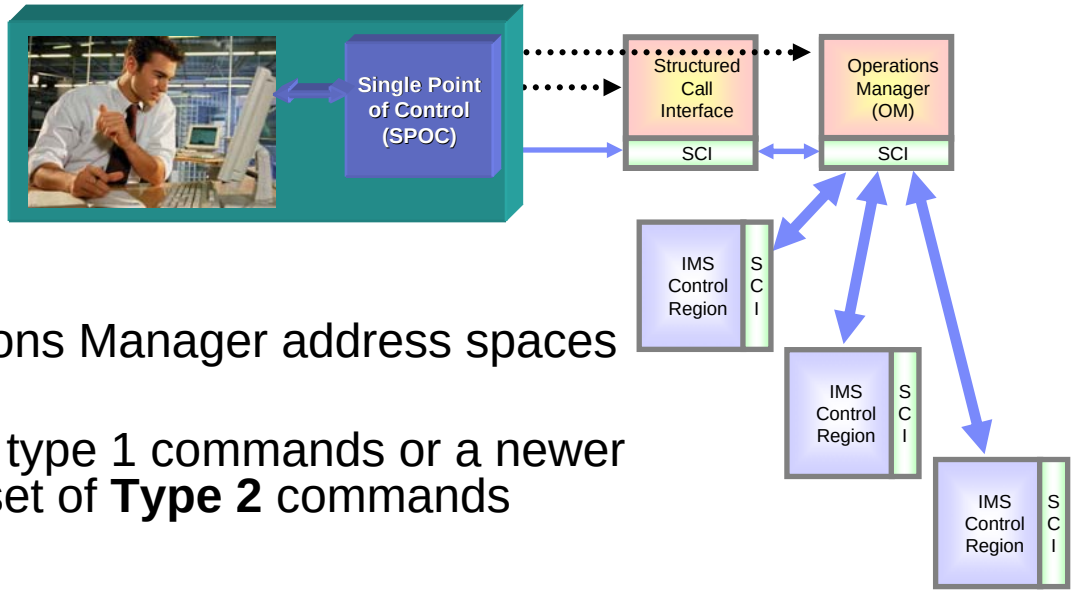


Operating IMS

IMS has been operated traditionally from z/OS Consoles or IMS terminals

- One IMS terminal can be identified as the Master Terminal for administration
- **Type 1** commands are used at terminals and consoles
  - e.g. /START … /DISPLAY …
  - Start with a "/" and are used to control IMS itself and its resources

Single Point of Control



- SPOC offers Communication to many IMSs in an IMSplex
- SPOC interacts with IMS Operations Manager address spaces
- Commands can be the traditional type 1 commands or a newer architected, simpler and smaller set of **Type 2** commands
  - e.g. QUERY … UPDATE …

IMS Application Programming Interfaces

- The traditional IMS API is a standard CALL facility, known as DL/I (data language interface)*
  - Often called “DL/1” or “data language one”
    e.g. CALL “CBLTDLI” USING ……
- DL/I Calls
  - Used to access IMS message queues
  - Used to access IMS DBs

Note: IMS databases are sometimes called “DL/1 Data Bases”

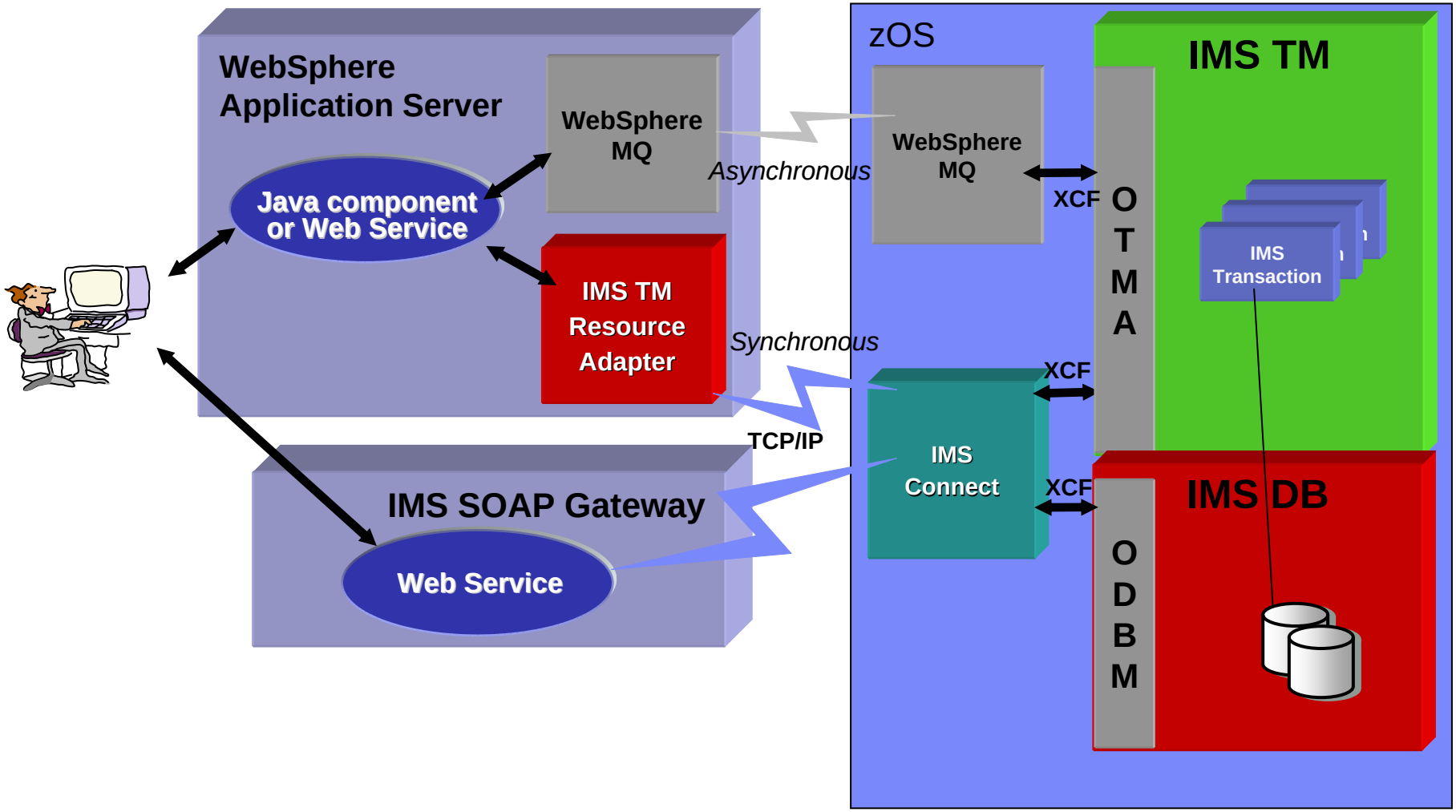
- SQL Calls are used to access DB2
- IMS Java applications can use JDBC for SQL access to IMS DB and DB2
- **Therefore IMS Java makes IMS Application Development much easier.**

Sample IMS Java Transaction

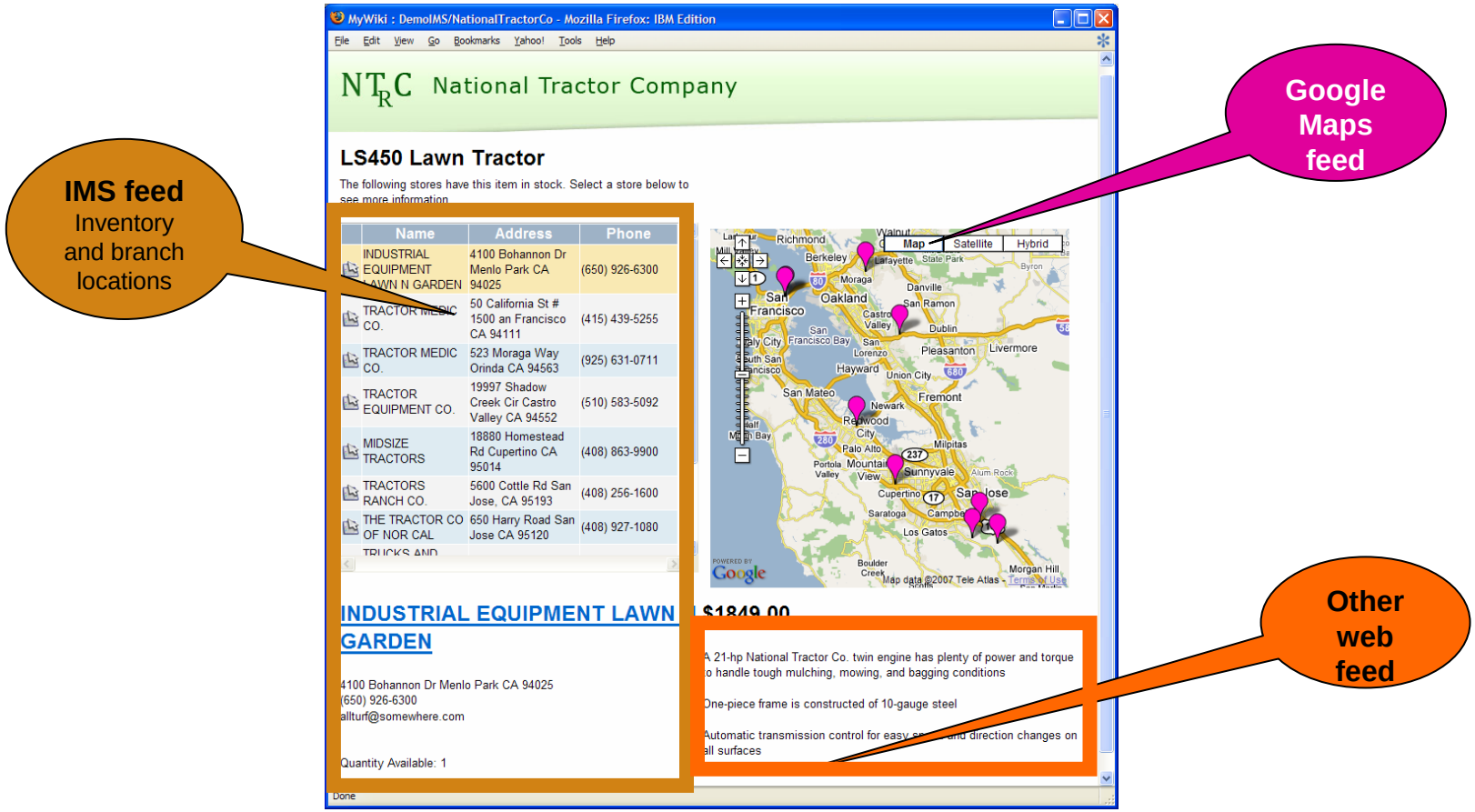
```
import com.ibm.ims.base.*;
import com.ibm.ims.application.*;

public class IMSecho extends IMSApplication {
    public IMSecho()  {}
    public void doBegin() throws DLIException, IMSException  {
        IMSMessageQueue messageQueue = new IMSMessageQueue();
        Message inputMessage = new Message();
        messageQueue.getUniqueMessage(inputMessage);
        Message outputMessage = new Message();
        outputMessage.setString("Message", inputMessage.getString("Message"));
        messageQueue.insertMessage(outputMessage);
        IMSTransaction.getTransaction().commit();
    }
    public static void main(String args[])  {
        IMSecho test = new IMSecho();
        test.begin();
    }
}
```

IMS SOA Integration

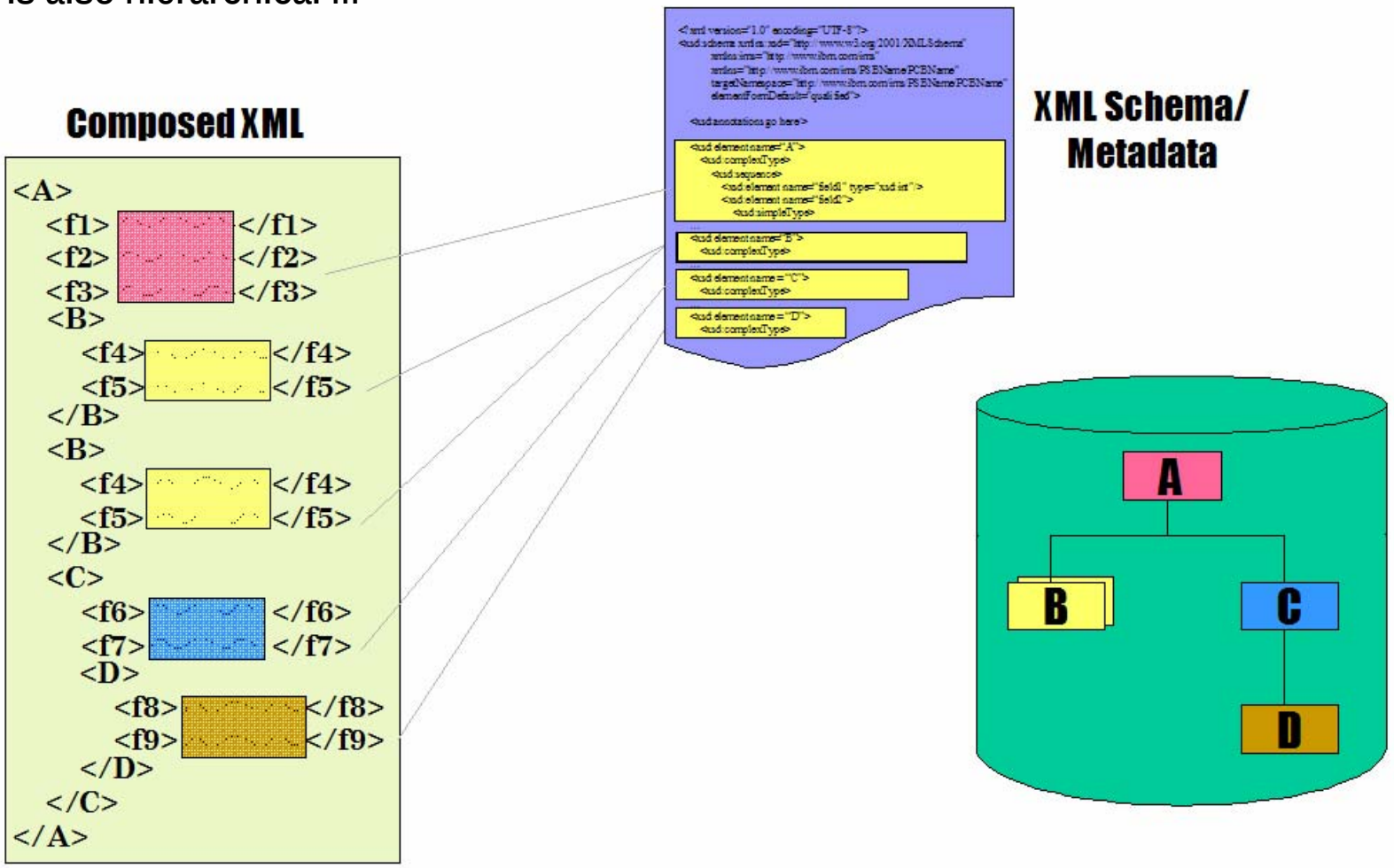


IMS & Web 2.0


IMS feed
Inventory and branch locations
Google Maps feed
Other web feed
MyWiki : DemoIMS/NationalTractorCo - Mozilla Firefox: IBM Edition
National Tractor Company
LS450 Lawn Tractor
The following stores have this item in stock. Select a store below to see more information
Name
Address
Phone
INDUSTRIAL EQUIPMENT LAWN N GARDEN
4100 Bohannon Dr Menlo Park CA 94025
(650) 926-6300
TRACTOR MEDIC CO.
50 California St # 1500 an Francisco CA 94111
(415) 439-5255
TRACTOR MEDIC CO.
523 Moraga Way Orinda CA 94563
(925) 631-0711
TRACTOR EQUIPMENT CO.
19997 Shadow Creek Cir Castro Valley CA 94552
(510) 583-5092
MIDSIZE TRACTORS
18880 Homestead Rd Cupertino CA 95014
(408) 863-9900
TRACTORS RANCH CO.
5600 Cottle Rd San Jose, CA 95193
(408) 256-1600
THE TRACTOR CO OF NOR CAL
650 Harry Road San Jose CA 95120
(408) 927-1080
INDUSTRIAL EQUIPMENT LAWN GARDEN
4100 Bohannon Dr Menlo Park CA 94025
(650) 926-6300
allturf@somewhere.com
Quantity Available: 1
$1849.00
A 21-hp National Tractor Co. twin engine has plenty of power and torque
One-piece frame is constructed of 10-gauge steel
Automatic transmission control for easy
all surfaces
Map
Satellite
Hybrid
Map data ©2007 Tele Atlas

XML Storage (Decomposed)

XML is also hierarchical ...

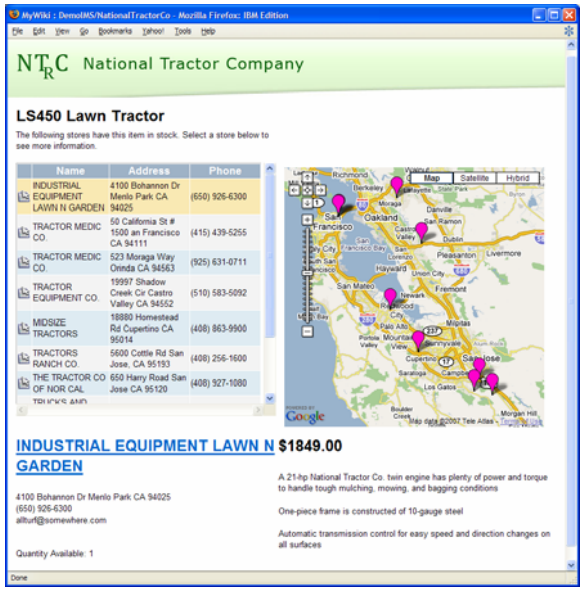


IMS Myths II

The truth about IMS...

- ... is **not** old fashioned.“

„IMS ...



IMS Myths II

The truth about IMS...

- ... is **not** old fashioned.“
- ... is used **very much**.“

„IMS ...

200 Million Users a Day

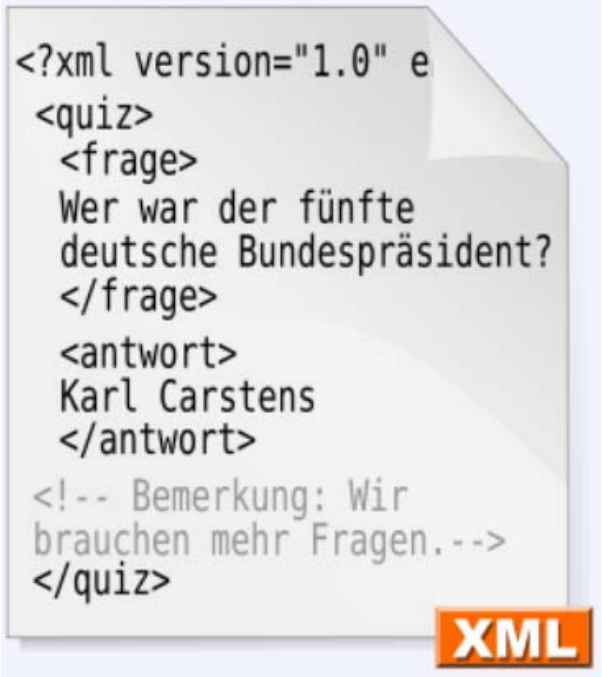
Over 3 million MIPS running IMS

IMS Myths II

The truth about IMS...

- ... is **not** old fashioned.“
- ... is used **very much**.“
- ... DB is hierarchical, which is **also** state of the art.“

„IMS ...



IMS Myths II

The truth about IMS...

„IMS ...

- ... is **not** old fashioned.“
- ... is used **very much**.“
- ... DB is hierarchical, which is **also** state of the art.“
- ... will **not** die in the next **15** years.“

20 Petabytes of Production Data

IMS Myths II

The truth about IMS...

„IMS ...

- ... is **not** old fashioned.“
- ... is used **very much**.“
- ... DB is hierarchical, which is **also** state of the art.“
- ... will **not** die in the next **15** years.“
- ... is **developed further rigth now**.“

IMS Myths II

The truth about IMS...

„IMS ...

- ... is **not** old fashioned.“
- ... is used **very much**.“
- ... DB is hierarchical, which is **also** state of the art.“
- ... will **not** die in the next **15** years.“
- ... is **developed further rigth now**.“
- ... is performing **very well**.“

Approx. 40.000 Trans/sec

IMS Myths II

The truth about IMS...

„IMS ...

- ... is **not** old fashioned.“
- ... is used **very much**.“
- ... DB is hierarchical, which is **also** state of the art.“
- ... will **not** die in the next **15** years.“
- ... is **developed further rigth now**.“
- ... is performing **very well**.“
- ... is **not that much** expensive.“

Depends on the value you get out of it...

Conclusions

Beginning in IMS is not easy,

but

it garantees compatibility up to the beginning of IT

and can be precisly tuned, optimized and offers therefore highest performance, reliability and investment security.

... and there are a lot of skilled people needed in the largest companies of the world, because their core businesses runs on System z and IMS.