

# Intelligent Connectionware

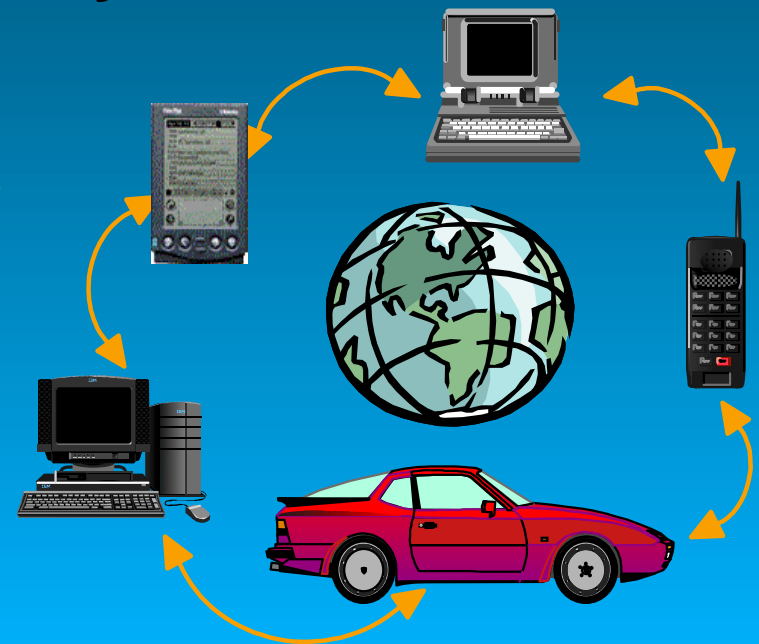
## TSpaces Technology

IBM Almaden Research Center

# Connecting Islands of Software

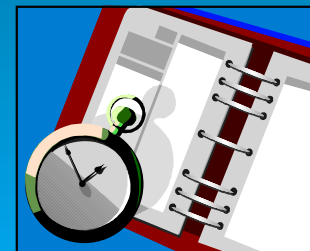
- **Software is everywhere**
  - PDAs, automobiles, corporate ERP systems
- **Connectivity is exploding**
  - Internet, Bluetooth, cellular
- **New technologies are emerging daily**

**Making it all work together is the challenge for the next decade!**



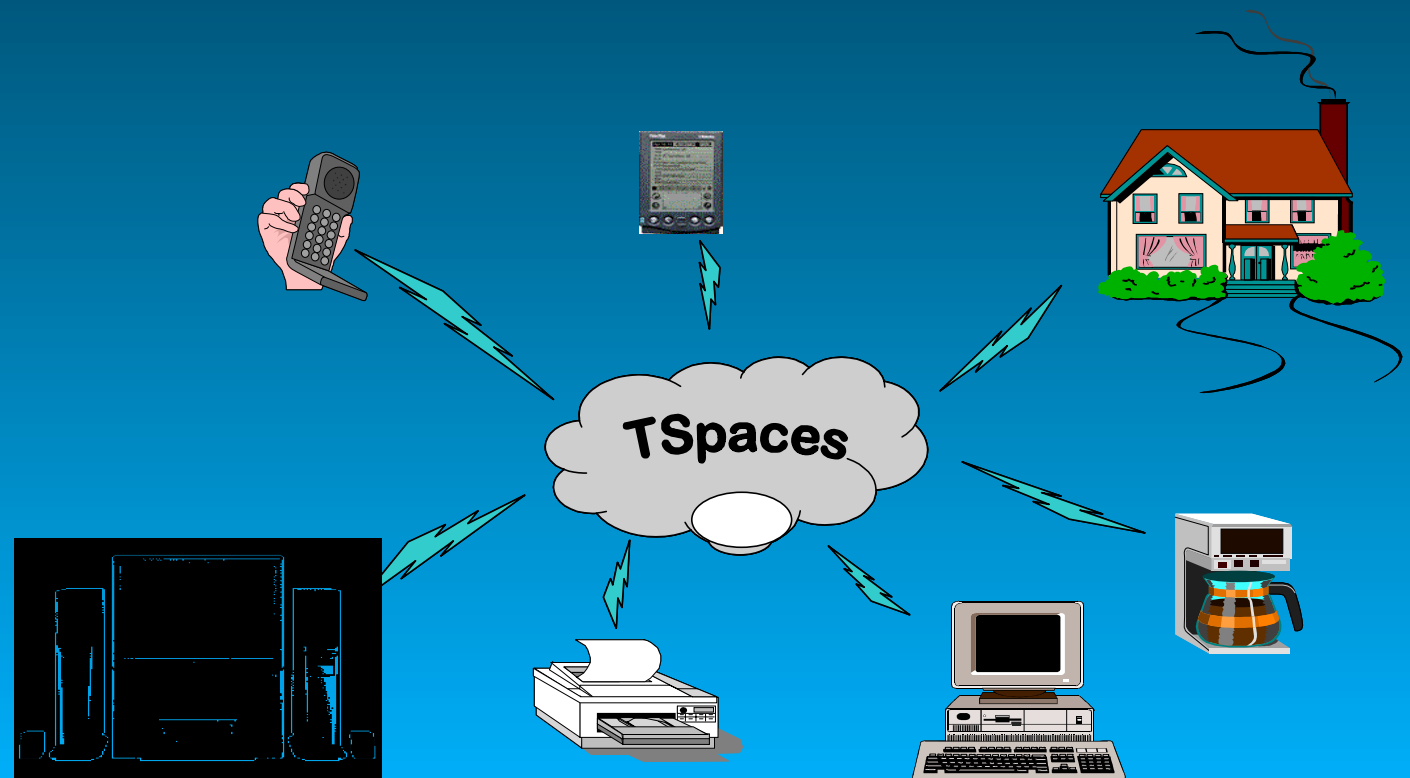
# TSpaces History

- **Developed at IBM Almaden to explore potential use of Java in middleware system**
- **Launched on IBM's alphaWorks web site in March 1998 with considerable success**
- **Licensed for use inside IBM and outside companies**
- **Plan to release as an IBM product**



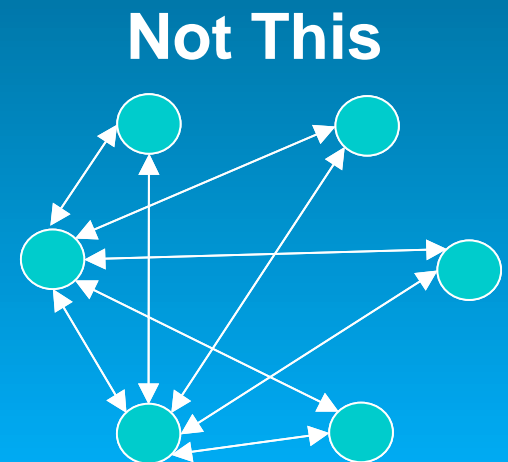
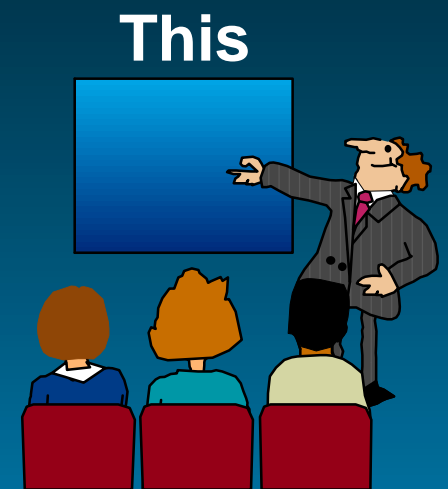
# TSpaces = Tuple + Database + Java

- Is a Java-based intelligent communication intermediary
- Simplifies and enables collaboration among network elements (users, devices, software programs and web sites)
- Receives, delivers and brokers communication and services



# The TupleSpace Model

- Global communication buffer (a shared message board)
  - Communication is anonymous and asynchronous
- Simple data structure (tuples)
  - Ordered vector of typed, and optionally named, fields with values
  - $\langle \text{"Sample"}, 5, \text{"foo"}, 9.5 \rangle$
  - $\langle \text{"merge sort"}, 4, [45, 67, 88, 93] \rangle$
- Simple model
  - Basic operations: write, take, waitToTake, read, waitToRead, scan, eventRegister, countN



# Competitive Advantage

- **Provide more functionality and intelligence**
  - Integrate industrial-strength database technology
  - Enable sophisticated queries
  - Manage groups of messages
  - Easy to customize and extend functionality
  - Support XML
- **Simple to use, lightweight**
- **Robust and reliable**
- **Promote rapid development of distributed applications**
  - Intuitive white-board application model
  - Flexible Java framework
  - Platform independent
- **Have opportunities across industries and applications**

# Tried and Tested Technology

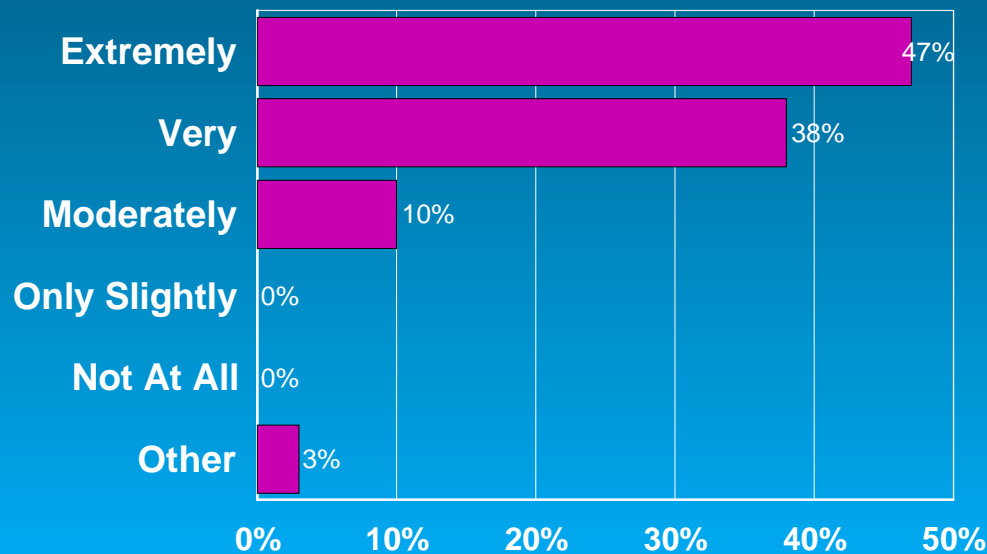
- **Thousands of downloads from IBM's alphaWorks web site**
- **Dozens of requests for commercial licenses despite no active marketing campaign**
  - Beta program in progress
  - Prospects range from Fortune 100 companies to NetGen .coms
- **Used today in IBM and customer production applications**
  - Lotus Domino Instant! Host
  - IBM InfoPrint Manager for NT
  - ...
- **Excellent feedback from customers and developers**

# alphaWorks Survey

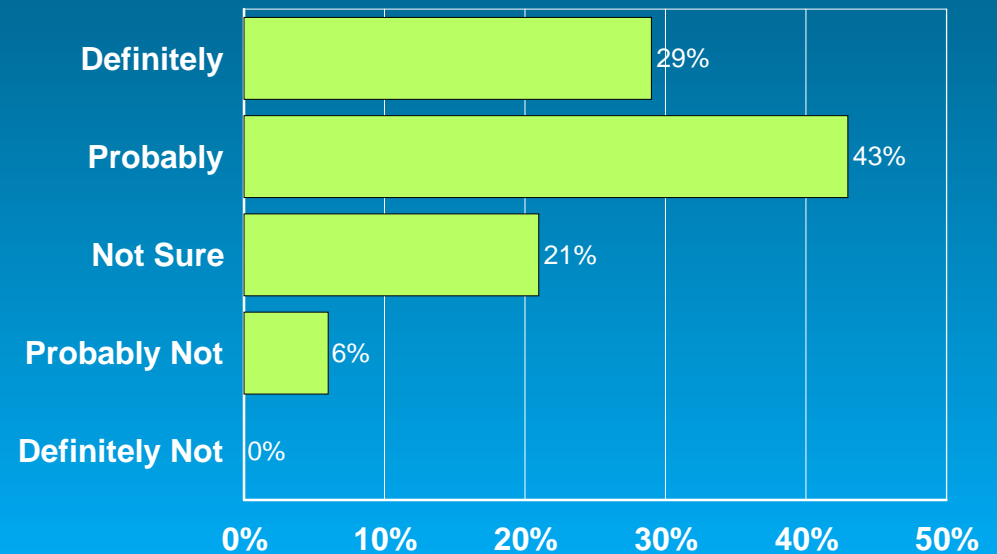
## ▪ Evaluation Scores:

- TSpaces' appealing rating (1-7 high) **5.2**
- Evaluators' likelihood to purchase (1-5 high) **3.9**
- Not a single negative comment!

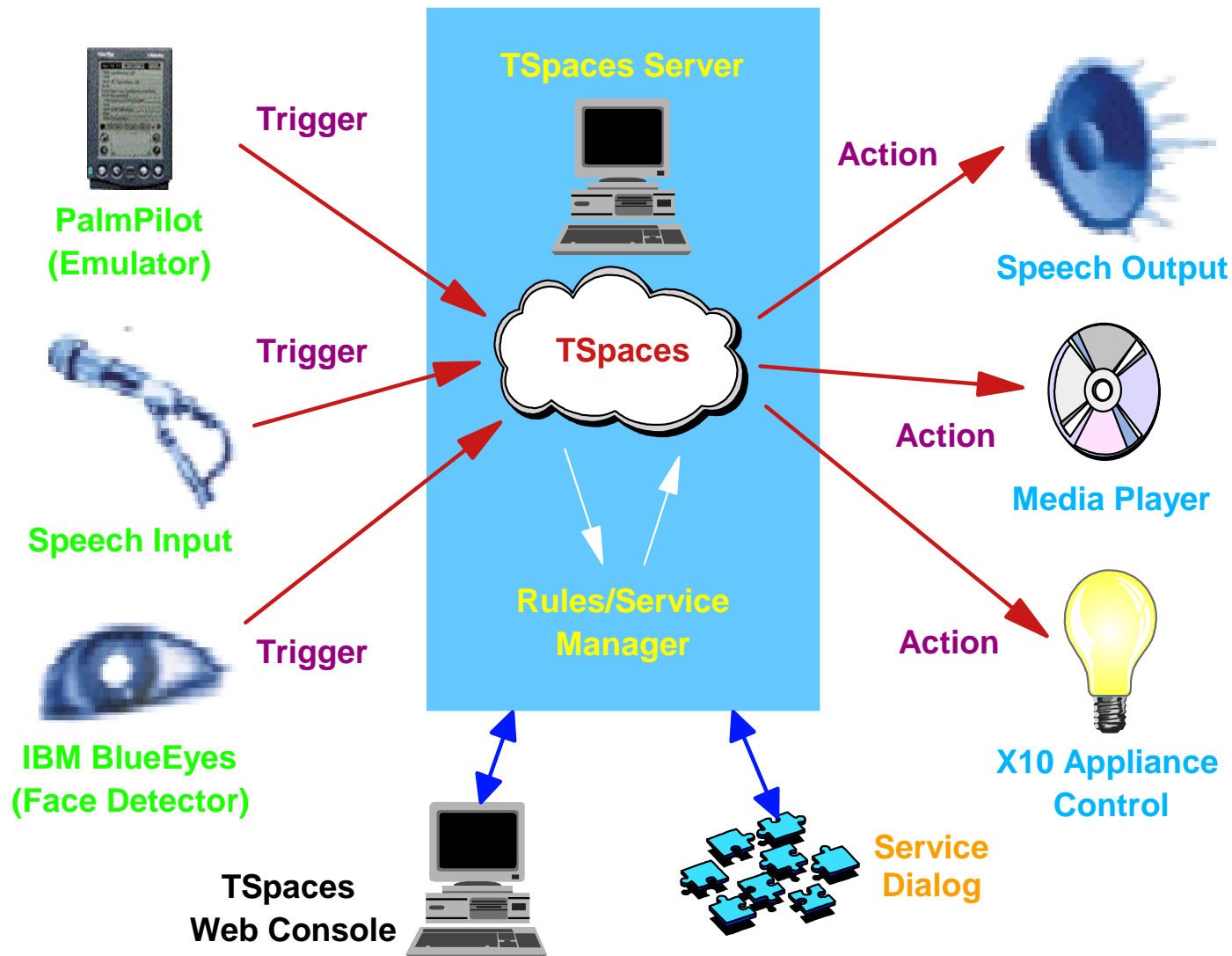
### Appealing



### Likely To Purchase

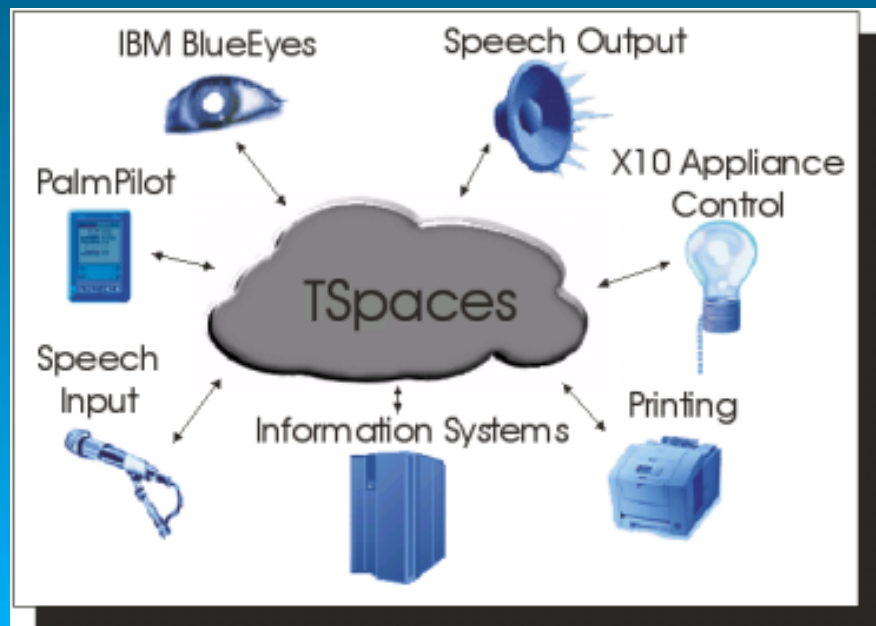


# TSpaces Demonstration



# Today: Intelligent Connectionware

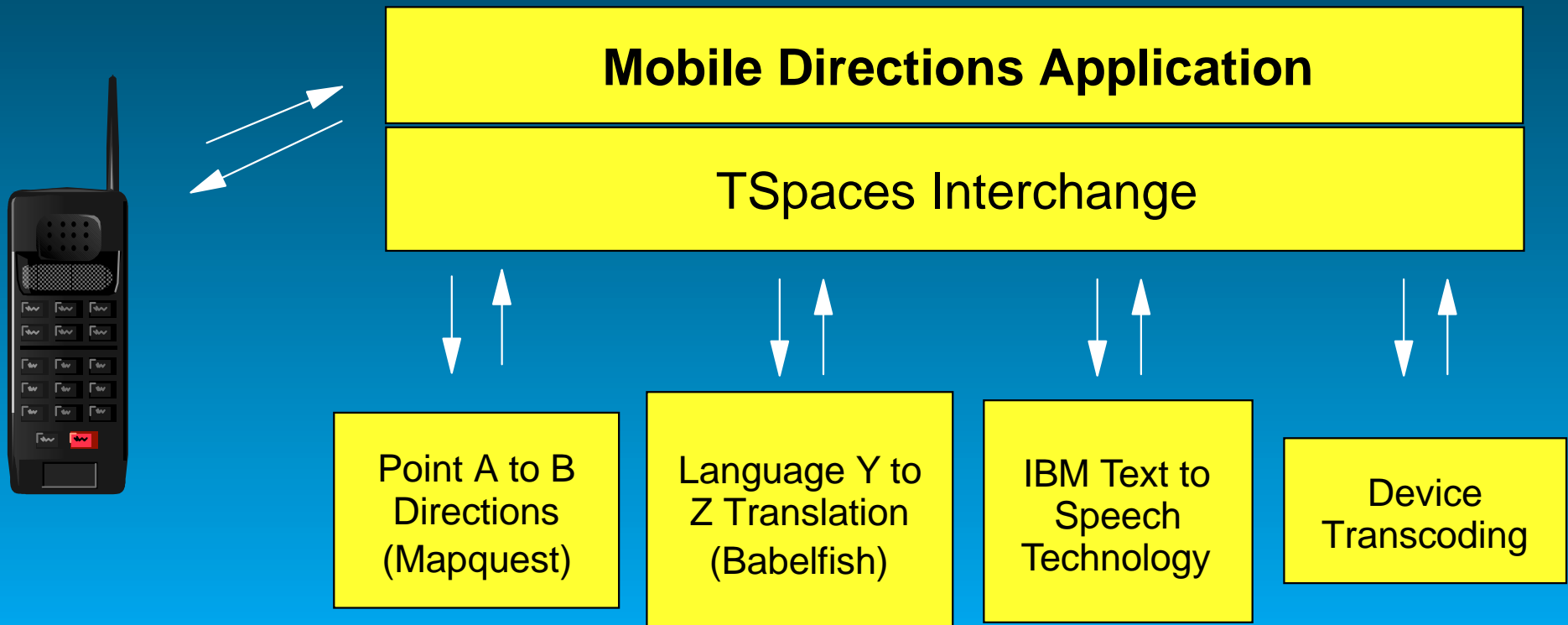
- Asynchronous messaging and event notification intermediary with persistent, transactional DBMS
- A natural platform for supporting:
  - Disconnected clients (e.g. wireless)
  - Transcoding agents
  - Legacy system or application gateways
  - Service advertising (publishing)



- **Customer Applications using TSpaces:**
  - System status command and control
  - Work queue coordination and tracking
  - Near real-time system for factory automation
  - Web-based financial brokerage messaging system

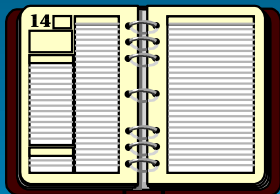
# Tomorrow: Internet Services

- **Web-site services (e.g. "Read directions to me in French on my cell phone")**



# Vision: The Dynamic Internet

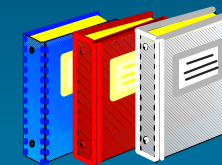
- TSpaces technology can transform the static Web into a dynamic service-based interchange and marketplace.
- Using TSpaces, networked elements (e.g., websites, devices, software, legacy applications) which currently provide static functions evolve into active elements which cooperate to provide aggregate services.



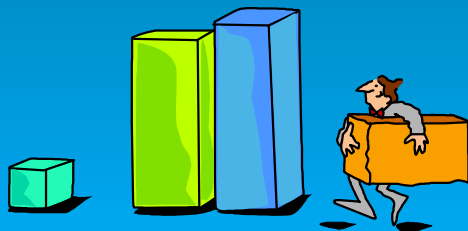
Personal Information Management



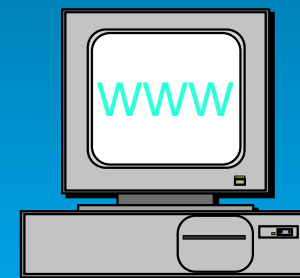
Office Workflow



Enterprise Resources



Inventory Management



Web Applications

# Enterprise TSpaces

- **The Enterprise TSpaces is an extension of the currently available stand-alone version of TSpaces. The goal of this project is to augment TSpaces with much needed industry-strength features such as fault-tolerance and scalability. We plan to make these features work seamlessly and be transparent to the client applications.**
- **Replicate spaces for fault tolerance**
  - ▶ Use replication group abstraction on top of the TSpaces servers.
  - ▶ Can dynamically adjust the number of TSpaces servers in a replication group.
- **Partition spaces for scalability**
  - ▶ Use partial replication or partitioning between two or more replication groups (partitions).
  - ▶ Can dynamically adjust the number of partitions.
- **Implement DB2-backed spaces for scalability and reliability**

# TSpaces Service Layer

- Services are emerging to allow anyone (including individuals, corporations, and automated agents) to access systems defined by other parties across the globe. The goal of the proposed project is to build a layer on top of TSpaces architecture to allow for the definition, discovery, management, and execution of these services.
  - Built using the TSpaces infrastructure
  - Based on UDDI and WSDL - IBM's proposals for services (XML and SOAP messages)
  - Allowed for the description, registration, subscription, discovery, and execution of services
  - Employed to build eMarketplaces/Service Delivery Platforms

- ✓ Turn the internet into a set of self-contained, independent services that can be discovered, authorized, employed, composed, and paid for.
- ✓ Create large dynamic systems that solve businesses' specific problems.

# A Horizontal Middleware Technology

- TSpaces
  - is the glue that pulls the puzzle pieces together
  - breaks down barriers and enables collaboration across disparate devices, services, platforms, and network

