IBM

Client Access
Programming Overview
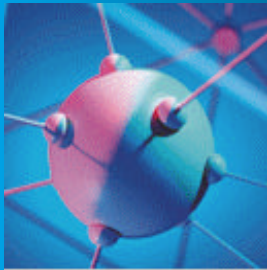
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IBM @server iSeries

Agenda

- Introduction
  - ➤ API
  - ➤ Strategy
  - ➤ Where to start?

- Traditional APIs
  - ➤ Industry Standards
  - ➤ iSeries Specific
  - ➤ Client Management

- Next Generation APIs
  - ➤ ActiveX automation objects and controls
  - ➤ OLE DB Provider
  - ➤ Java tools

- iSeries Navigator
  - ➤ Plug-ins
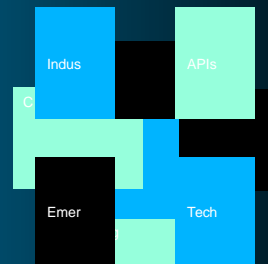
- Where to start

- What's new

API – a definition

- A set of method calls

- An object supporting data flows or a service from program to program

- A software development kit
  - Visual such as Visual Basic
  - Non-visual   such as ODBC
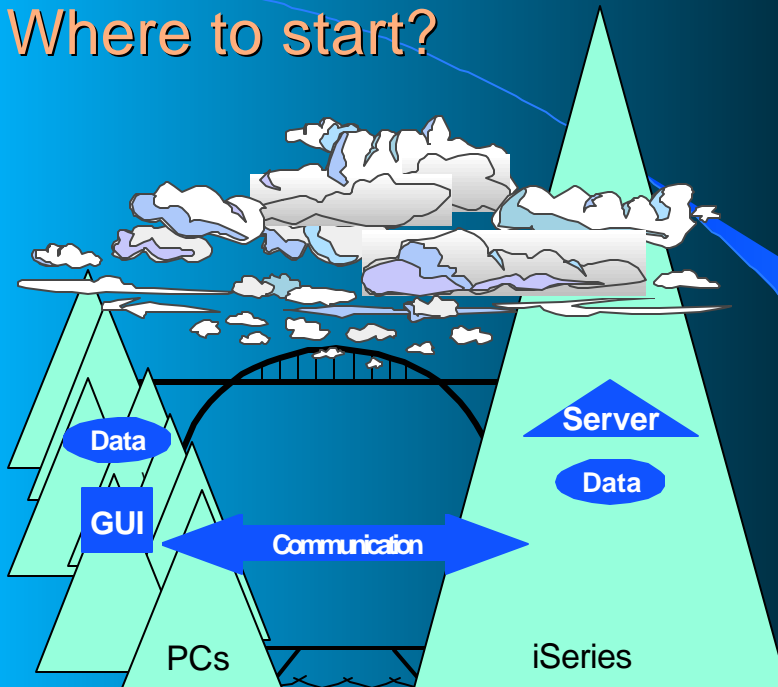
- Any combination of the above
  -

- "The interface (calling conventions) by which an application program accesses operating system and other services. An API is defined at **source code level** and provides a **level of abstraction** between the application and the kernel (or other privileged utilities) to ensure the portability of the code. An API can also provide an interface between a high level language and lower level utilities and services which were written without consideration for the calling conventions supported by compiled languages. In this case, the API's main task may be the translation of parameter lists from one format to another and the interpretation of call-by- value and call-by-reference arguments in one or both directions." From Denis Howe's FOLDOC.
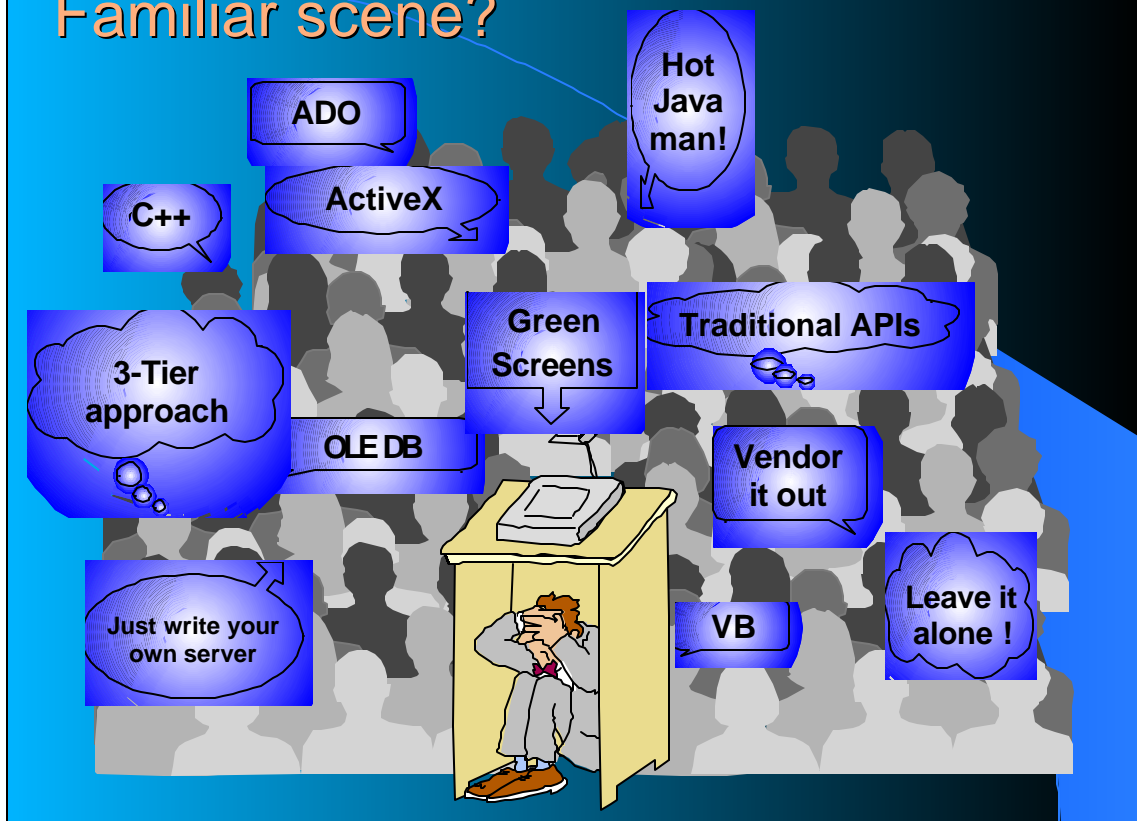
iSeries Access Strategy

- Support industry APIs where it makes sense

- Supplement with iSeries Access specific APIs
  - Provide consistent interfaces
  - Create a complete set of client/server APIs
  - Enable client management

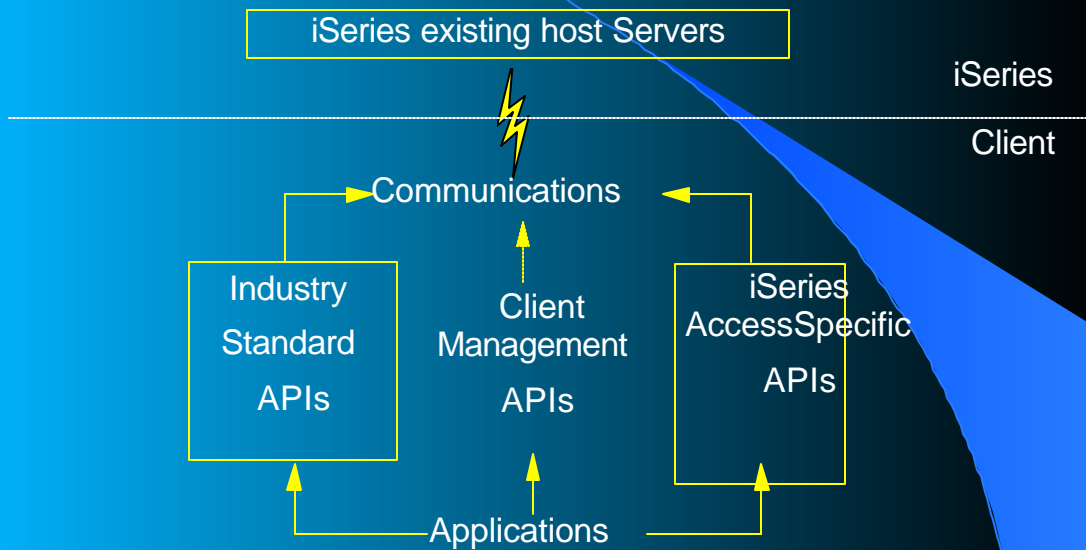- Support emerging technologies
  - Java
  - ActiveX
  - OLE DB

Indus   APIs

Emer   Tech

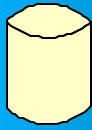# Where to start?

PCs

iSeries

Data

GUI

Communication

Server

Data

Familiar scene?

ADO

ActiveX

C++

Hot Java man!

3-Tier approach

Green Screens

Traditional APIs

OLE DB

Vendor it out

Just write your own server

VB

Leave it alone !

Traditional APIs

- Industry Standards
- Client Access specific
- Client Management

Traditional API structure

iSeries existing host Servers

iSeries

Client

Communications

Industry Standard APIs

Client Management APIs

iSeries AccessSpecific APIs

Applications

Industry Standard APIs

DATABASE
- **ODBC**
- **JDBC**
- **OLE DB**

APPLICATIONS
- **EHLLAPI**
- **DDE**

COMMUNICATIONS
- **Sockets**

FILES

PRINT

iSeries Specific APIs

Data Queue

Remote Comand

Distributed Program Call

File Transfer

Multimedia

Client Management
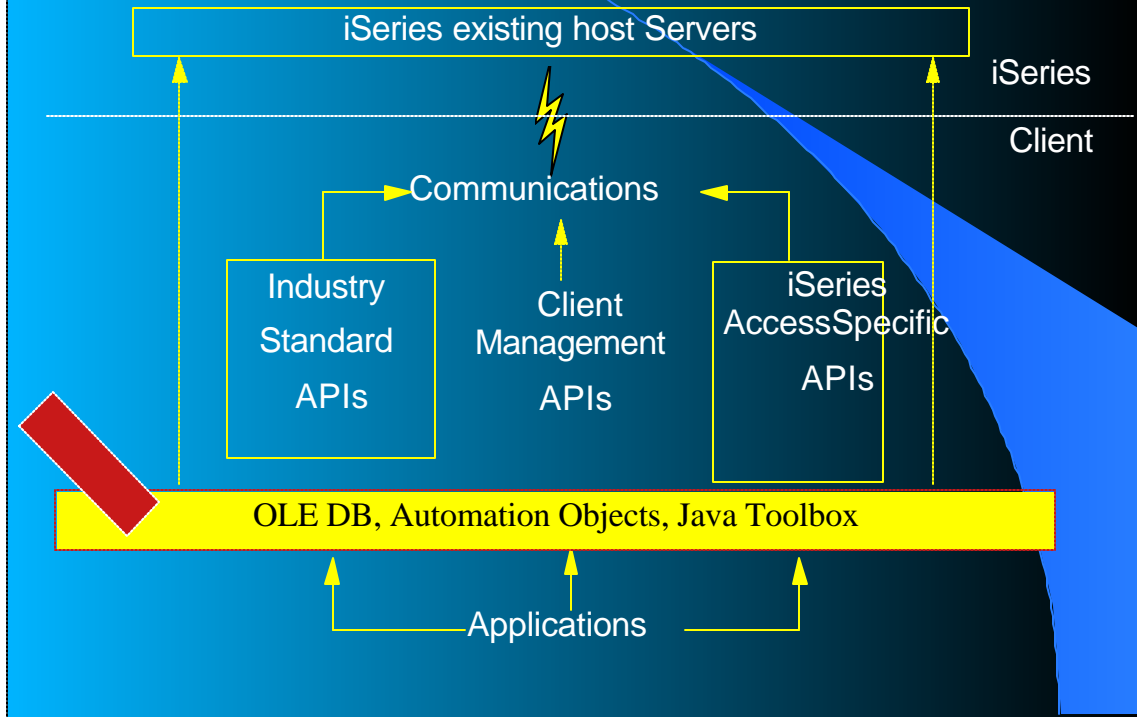
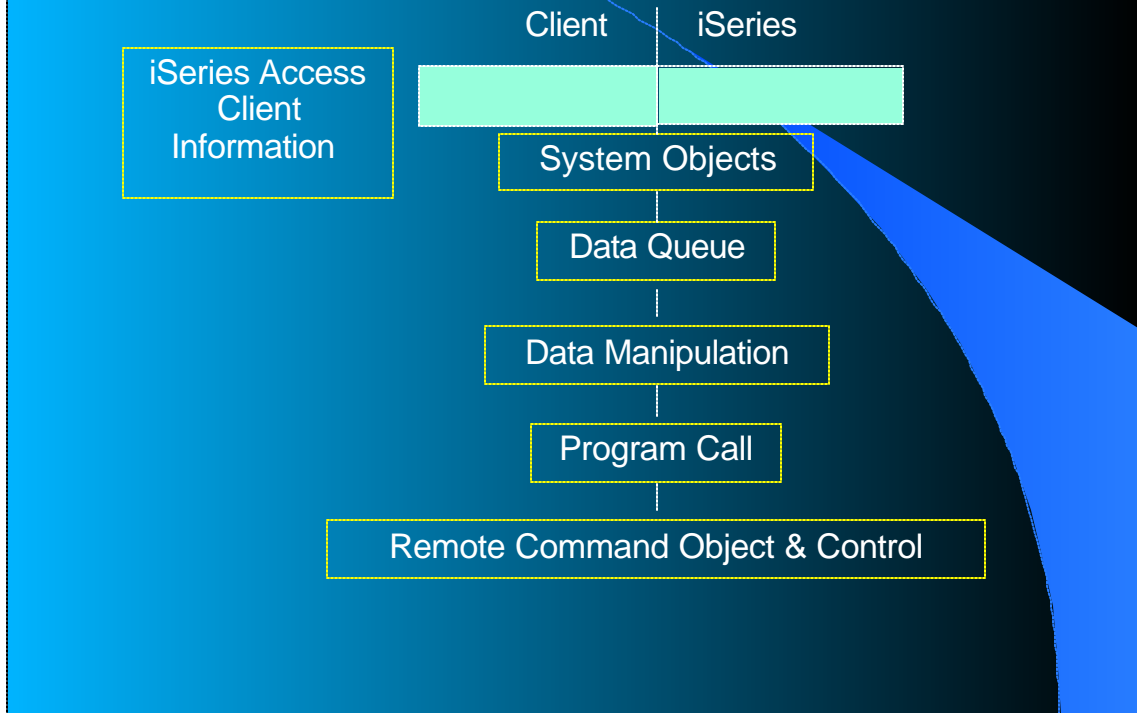Security

Service

Update

Data Transformation

NLS

Next Generation APIs

- ActiveX Automation objects and custom controls
- OLE DB Provider & Wizards
- IBM Toolbox for Java
- .Net
- iSeries Navigator Plug-ins

Next Generation API structure

iSeries existing host Servers

iSeries

Client

Communications

Industry Standard APIs

Client Management APIs

iSeries AccessSpecific APIs

OLE DB, Automation Objects, Java Toolbox

Applications

ActiveX Automation Objects

Client | iSeries

iSeries Access Client Information

System Objects

Data Queue

Data Manipulation

Program Call

Remote Command Object & Control

OLE DB Provider

1. Middleware layer provides interface to iSeries data and services (runtime)
   - ➤ ActiveX Data Objects (ADO)
   - ➤ Can manipulate records directly, not through SQL
   - ➤ Easy access to

✔ Keyed record level access	✔ SQL stored procedures
✔ Data Queues	✔ Programs
✔ SQL statements	✔ CL commands

2. Programmer's Toolkit
   - ➤ Wizards generate code in a Visual Basic project
   - ➤ Provides interfaces to manage Stored Procedures and Data Queues
   - ➤ Documentation and samples

OLE DB Tool Integration

1. Any OLE Compliant Tool can use OLE DB (IBMDA400)
   - ➤ Visual Basic,
   - ➤ Delphi,
   - ➤ PowerBuilder,
   - ➤ VBScript

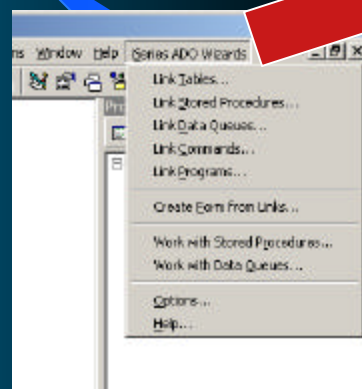2. Wizards are for Visual Basic only

3. Fast keyed record level access to DB2/400

4. Easier to build Client/Server Applications

Toolbox for Java

1 Interfaces for Java programs to access iSeries data and resources:

- ✔ Infrastructure to communicate with the iSeries
- ✔ User ID and password
- ✔ Jobs, messages, objects, system values and info
- ✔ Data queues
- ✔ JDBC for SQL
- ✔ Record-Level database access (keyed)

- ✔ User Space access
- ✔ Command call
- ✔ Program call
- ✔ Code page and data type conversion
- ✔ Integrated File System access
- ✔ Network print

2 Provides beans for the public interfaces
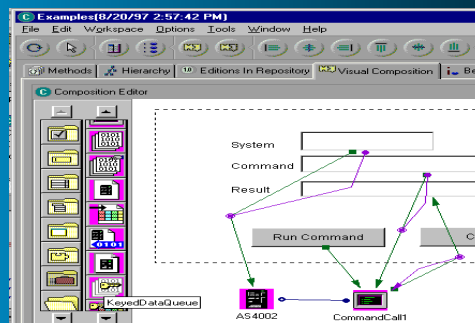
.Net

1 Interfaces for .Net programs to access iSeries database:

- ✔ Bridge to ODBC drivers   Microsoft.Data.Odbc
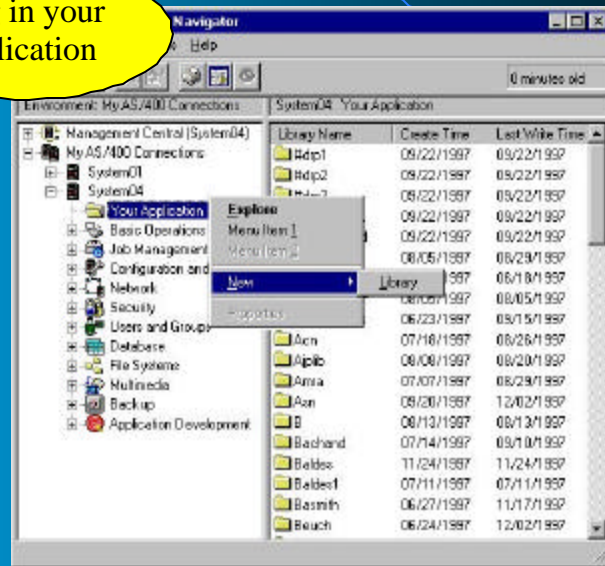- ✔
- ✔ Bridge to OLE DB providers   System.Data.OleDb

2 IBM investigating a native provider (i.e. no bridge) for the fastest possible and most reliable data access from the .Net framework

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iSeries Navigator

Plug in your application

iSeries Navigator Plug-ins

1. Allows you to add your own applications to iSeries Navigator

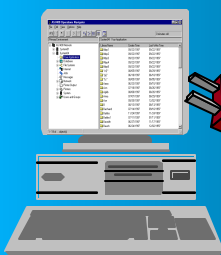2. Allows you to be part of the iSeries user interface of choice

3. Use iSeries Access install to distribute your applicat...

4. Applications currently using the support
   - ✔ Domino server
   - ✔ Java VM

Use Plugin Support to add your application to Operations Navigator
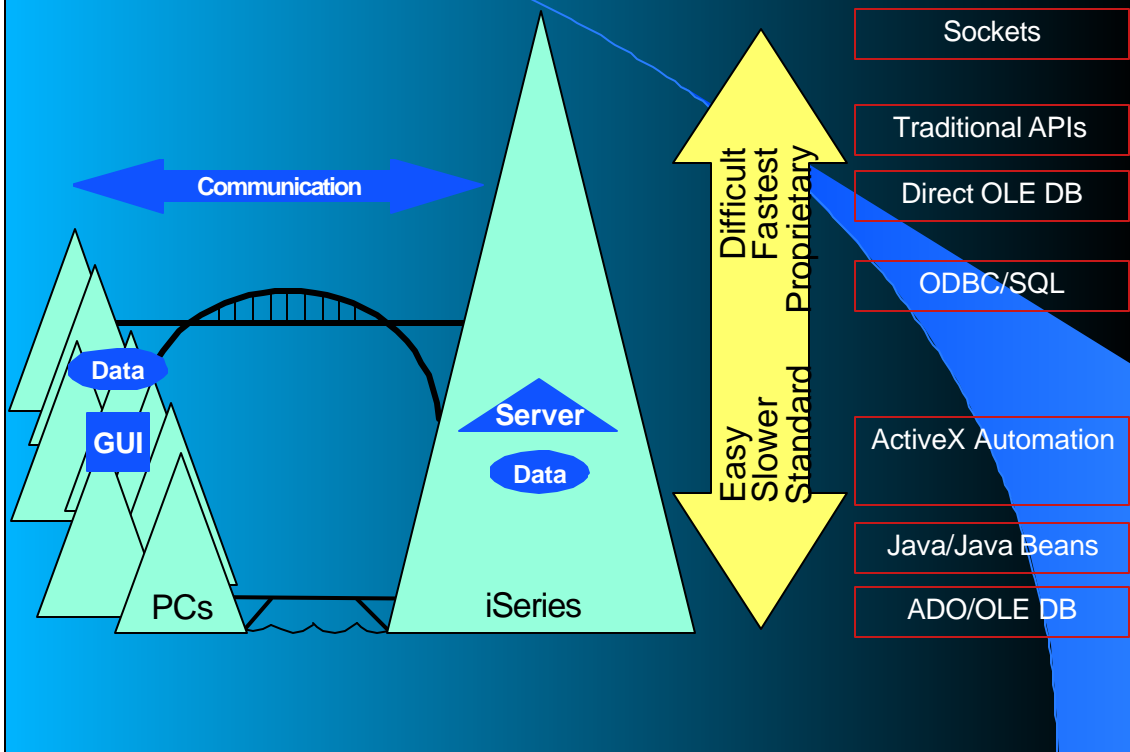
Third Party Tools

1 Examples

- ➤ Seagull
- ➤ Delphi/400
- ➤ ASNA
- ➤ Jacada
- ➤ HiT
- ➤ …

2 Characteristics

- ✔ Often have their own server
- ✔ Often claim better performance than others
- ✔ Usually proprietary

Where to start?

Communication

Data

GUI

Server

Data

PCs

iSeries

Difficult
Fastest
Proprietary

Easy
Slower
Standard

Sockets

Traditional APIs

Direct OLE DB

ODBC/SQL

ActiveX Automation

Java/Java Beans

ADO/OLE DB

Functions supported

	C/C++ APIs (traditional)			ActiveX		Java
	Non-IBM	IBM	ODBC	Automation Objects	OLE DB	Java Toolbox
Record level DB2/400 database access					X	X[18]
SQL Statements		X	X	X[10]	X[6]	X[1, 18]
Call Stored Procedure		X	X	X[10]	X	X[1, 18]
Call AS/400 Program (parameter I/O)		X		X[3]	X	X[18]
Call AS/400 Command		X		X[3, 13]	X	X[18]
Data Queue (FIFO, LIFO, Keyed)		X		X[3, 13]	X[2]	X[18]
Data Area						X
Integrated File System						X[18]
User Space						X
Data Manipulation (code page, data type)		X	9	X[12, 19]	4	X[12]
Network Print		X				X
Multimedia (USF)		X				
Security		X				X
Service		X				X
Directory Update		X				X
Client Access Client Information		X		X		
AS/400 Connection management		X		X		X
List of AS/400 systems		X		X[13]		
Jobs		X[8]				X[18]
Messages		X[8]				X[18]
Manipulate print resources		X[8]				X[18]
Object Authorities						X
System Values						X
System Status information						X
Users and groups						X
Operations Navigator Plug-In		X[7]				
Object Lists						X
Operations Navigator Control				X		
PC5250 Emulator control (HACL)	X[15, 16]			X[15, 16]		
EHLLAPI (and PCSAPI)	X					
ENPTUI						X[5]
Code generation or Wizards				X[17]		
DDE in PC5250 Emulator	X					
File access	X[14]					
LDAP	X					
Sockets						X

- Using JDBC
- Reads all entries on the queue even for keyed data queues
- Automation objects require developer to transform host data
- OLE DB transforms data automatically, but complex types are not supported
- Has wrapper classes
- No commitment control or SELECT for UPDATE
- Class implementation that can be in Java, C++, or Visual Basic
- This is the same as System Object Access
- ODBC transforms data automatically, but only SQL types are supoorted
- These are simple wrappers of the C/C++ APIs
  If the API supports the new System Object
- Complex data types such as structures and arrays supported
- Custom control still available
  Regular file I/O and 95/NT Network Drives to AS/400s configured with Netserver (don't need CA for this)
- This library is like EHLLAPI, but has more capability
- C++ language only
  Code generating wizards for Visual Basic
- Java GUI class is available here
- Not in Lotus script

New or changed significantly for Client Access Express

To Use or Not to Use?

|	C/C++ APIs (traditional)		ActiveX		Java
	IBM interfaces	ODBC	Automation objects	ADO / OLE DB	Java Toolbox
Performance	Best performance (if coded properly)	Best performance for SQL			
Language	Difficult to use in anything except C/C++	Most languages/tools add function to support ODBC calls	Language independent (must support COM)	Language independent (must support COM)	Must use the Java language
OS	Windows only	ODBC SQL on many platforms	Windows only	Windows only	Platform independent
Standards?	Different coding for each type of data or service access	Standard way to access relational data	IBM defined the interface	Microsoft defined the interface	IBM defined the interface (except JDBC)
Binding		Automatically binds data (translation and conversion)	Requires developer to translate and convert data (API provided)	Automatically binds data (translation and conversion)	Requires developer to translate and convert data (API provided)
Complex data		SQL data types only	Handles complex data types (call system APIs)	All but complex data types (i.e. structures)	Handles complex data types (call system APIs)
Coding model	Many API calls for one kind of data or service access	ODBC SQL common across platforms	Each data or service access has its own interface	One common object model for all data and service access	Each data or service access has its own interface
Record level access				Keyed record-level access	Keyed record-level access
Code generation tools				VB wizards to get you started in ADO	XML Framework for GUI building and program call
Connecting	Connections in iSeries Access can occur on the fly	Must configure Datasource connections	Connections in iSeries Access can occur on the fly	Connections in iSeries Access can occur on the fly	Connections can occur on the fly
Coverage	Broad functional coverage	Most mature/robust (older and highly used)			Broad functional coverage
Support					More IBM resource behind Java

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What's New in V5R1?

1 System object (across all functions)

2 Automation objects
- ✔ Program, Command, Data Queue, Data Transfer

3 Java Toolbox
- ✔ Uses iSeries Client Access as a ship vehicle
- ✔ Two new Java tools: GUI Builder and Resource Script Converter

4 Support additional data types
- ✔ BIGINT
- ✔ LOBs

What's New in V5R1?

5 iSeries Navigator Plug-In
- ✔ Support Java and VB for Plug-Ins

6 Unicode support

7 ODBC now supports:
- ✔ MTS 2.0
- ✔ Wide API set
- ✔ Static cursor

APPC

SNA   16-bit

Network Print

LSAPI
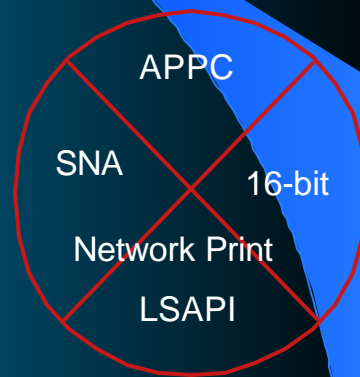
What's New in V5R1?

Programmer's Toolkit – Pulling it Together

- Documentation
- Headers, type libraries
- Sample Programs

API and Tech Reference
- API Descriptions
- Typical Usage
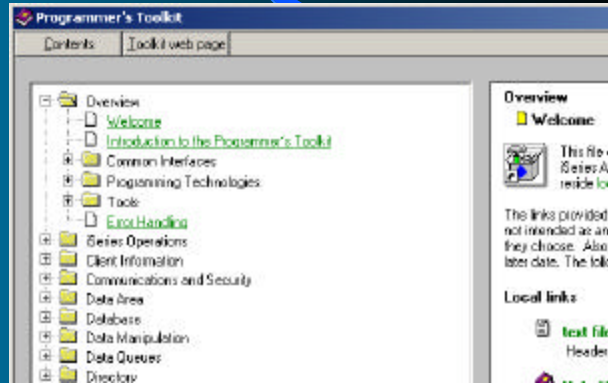
Programmer's Toolkit
- Help center
- Samples on web

- SDK in Toolkit
- API Tech Ref online only

- Data Transfer ActiveX Automation

What's New in V5R2?

1 Kerberos support for any iSeries Access connection

2 Automation objects
- ✔ Lotus 123 V9 format for Data Transfer

3 Java Toolbox
- ✔ Wireless API's (com.ibm.as400.micro)
- ✔ Clustered Hashtables
- ✔ Record Format Markup Language (RFML)
- ✔ iSeries System Debugger
- ✔ JDBC 3.0 Support
- ✔ JTOpen 3.2 has been released
- ✔ Support for JSSE

4 Additional data types
- ✔ ROWID

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What's New in V5R2?

5 64K SQL statement size

6 ODBC now supports meaningful information from the SQLTablePrivileges and SQLColumnPrivileges

7 ODBC and OLE DB now support additional base table information

8 OLE DB now supports updatable SQL cursors

9 Multiple databases on the same system (IASPs)

References

- AS/400 Client/Server
  - http://www.ibm.com/servers/eserver/iseries/access/
- Client Access Toolkit
  - http://www.ibm.com/servers/eserver/iseries/access/toolkit
- Client Access OLE DB Provider
  - http://www.ibm.com/servers/eserver/iseries/access/oledb
- Java
  - http://www.ibm.com/servers/eserver/iseries/toolbox/
  - http://www.software.ibm.com/ad/vajava
- iSeries Navigator
  - http://www.ibm.com/servers/eserver/iseries/navigator/
- Online documentation
  - http://www.ibm.com/servers/eserver/iseries/library/
  - http://as400bks.rochester.ibm.com

Books

- Client Access Reference Manuals
  - SC41-5507-02 Client Access/400 for Windows Setup - V5R1M0
  - SC41-3513 Client Access/400 for Windows 95 API and Technical Reference
- Client Series Redbooks
  - GG24-4027 AS/400 Client Series - Products and Positioning
  - GG24-4285 AS/400 Client Series Handbook
  - SG24-5191 AS/400 Client Access Express for Windows: Implementing V4R4M0
  - SG24-5183 A Fast Path to AS/400 Client/Server Using AS/400 OLE DB Support

- Other References
  - SC41-3554 Client Access/400 PC5250 Programmer's Guide
  - SC41-3652 Ultimedia System Facility Programming Guide
  - GG24-3070 Bibliography of International Technical Support Organization Technical Bulletins
  - Microsoft Open Database Connectivity Software Development Toolkit Version 3.0: Programmer's Reference

Summary

- Use the correct API set that suits your business needs.

- Take advantage of the iSeries Information Center

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