# 64 Bit Delphi
# What does it all mean?

David Intersimone "David I"
VP of Developer Relations and Chief Evangelist
davidi@embarcadero.com
http://blogs.embarcadero.com/davidi
Twitter:  davidi99
Skype: davidi99

# Agenda

- RAD Studio Product Family Overview

- 64bit computing – What's the same? Different?
  - Data types
- The CPU - Instructions, Addresses
- What this means for Delphi
- What can I do today?

- Q&A

# Product Editions

## Delphi XE

- Starter
- Professional
- Enterprise
- Architect

## C++Builder XE

- Starter
- Professional
- Enterprise
- Architect

## Delphi Prism XE

- Professional
- Enterprise

## RadPHP XE

## RAD Studio XE

- Professional
- Enterprise
- Architect

Included all IDE's

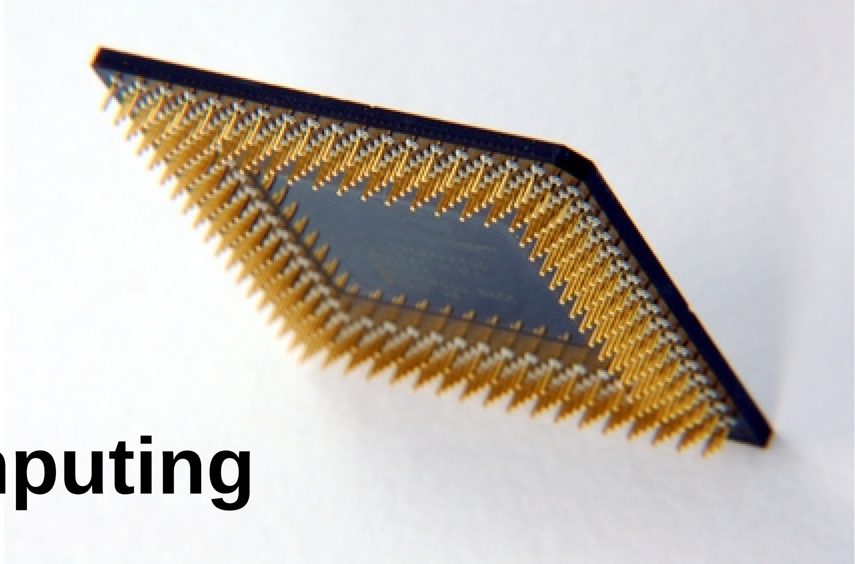
ER Studio Developer Edition
Included on Architect edition

InterBase Developer Edition FREE
for development

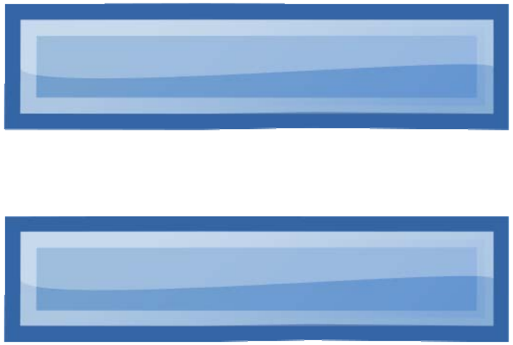
# Delphi XE and C++Builder XE Starter Edition

- Low cost solution for hobbyists, students, and independent developers to be able to get started building and distributing apps
- VCL Form Designer to visually build native Windows applications
- Full-featured debugger with color syntax highlighting
- Hundreds of included components
  - Touch and Gesture support
  - Ribbon Controls
  - IBX for database development
  - Allow third party components

# Bit Computing



# What’s the same?

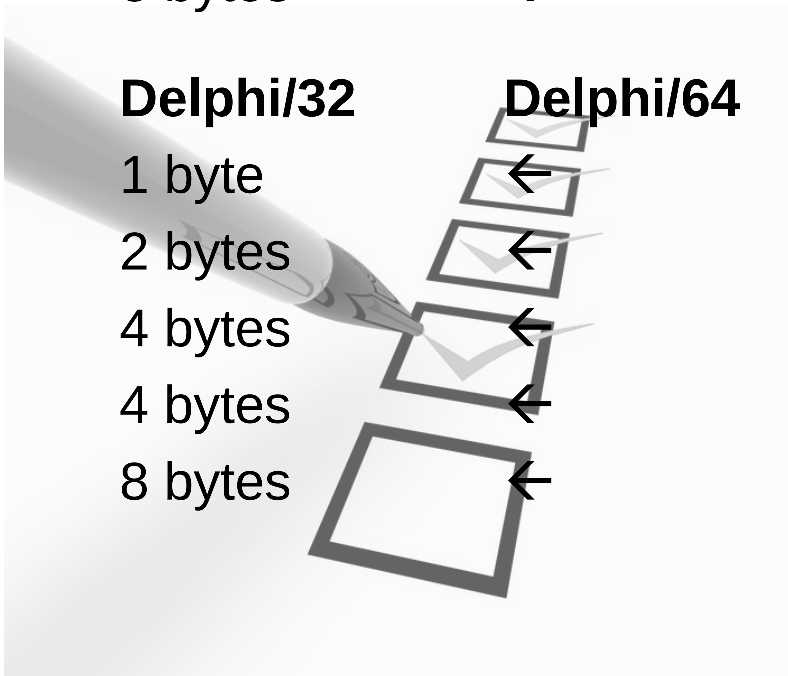


- Integer, Longint, Cardinal – still 32bits
- Int64, UInt64 – still 64bits
- UnicodeString, AnsiString, WideString
- Exceptions
- Runtime Library (RTL)
- SysUtils, Classes, etc…

# Delphi 32 and 64-bit Type Sizes

| Signed types | Delphi/32 | Delphi/64 |
|---|---|---|
| ShortInt | 1 byte | ← |
| SmallInt | 2 bytes | ← |
| LongInt | 4 bytes | ← |
| Integer | 4 bytes | ← |
| Int64 | 8 bytes | ← |

| Unsigned types | Delphi/32 | Delphi/64 |
|---|---|---|
| Byte | 1 byte | ← |
| Word | 2 bytes | ← |
| LongWord | 4 bytes | ← |
| Cardinal | 4 bytes | ← |
| UInt64 | 8 bytes | ← |



# What’s different?

- NativeInt, NativeUint – 64bits
- Pointer (all pointers) – 64bits
- Dynamic Arrays – 64bit indexing
- Floating point math - Double

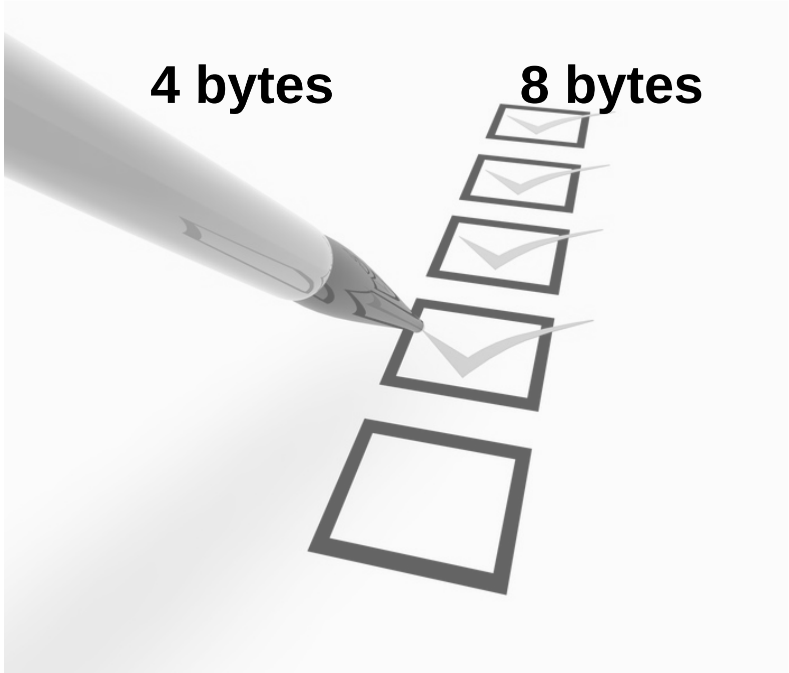
# Delphi 32 and 64-bit Type Sizes

| **Signed types** | **Delphi/32** | **Delphi/64** |
|---|---|---|
| NativeInt | **4 bytes** | **8 bytes** |

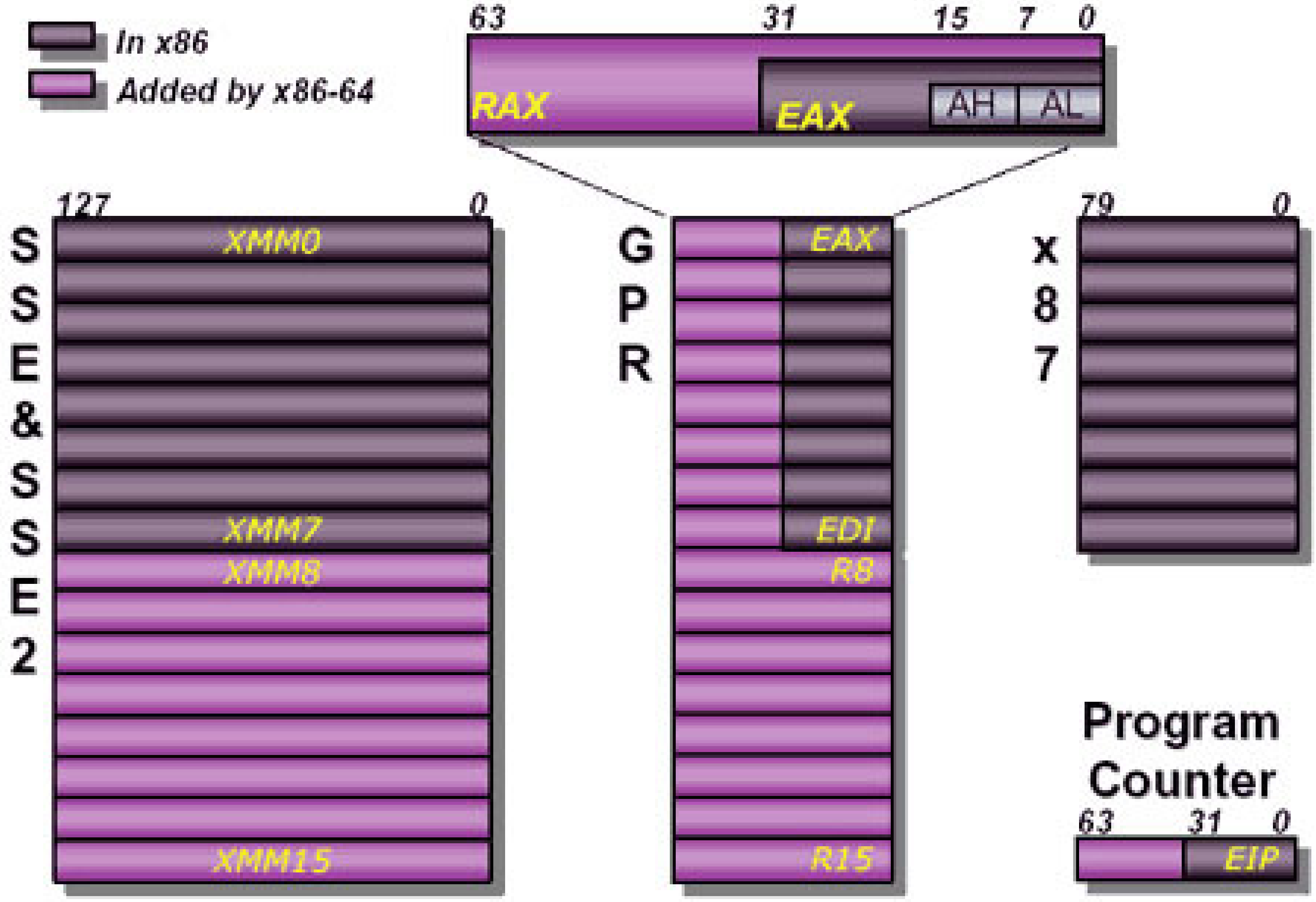
| **Unsigned types** | **Delphi/32** | **Delphi/64** |
|---|---|---|
| NativeUInt | **4 bytes** | **8 bytes** |

# Delphi 32 and 64-bit Pointer Types

| Pointer types | Delphi/32 | Delphi/64 |
|---|---|---|
| Pointer | 4 bytes | 8 bytes |
| String | | |
| Class instance | | |
| Class reference | | |
| Interface | | |
| AnsiString | | |
| WideString | | |
| UnicodeString | | |
| Procedure pointer | | |
| Dynamic array | | |
| PAnsiChar | | |
| PWideChar | | |
| PChar | | |



# The CPU – Programming model



# Instructions and Addresses

- 64 bit address space
- Limited by physical hardware
- Same core Intel instruction set
- New REX prefix for 64bit instructions
- RIP-relative addressing
- Jumps – relative +/- 2GB
- 16 byte stack alignments

- Online resources
  - http://msdn.microsoft.com/en-us/magazine/cc300794.aspx
  - http://msdn.microsoft.com/en-us/library/7kcdt6fy.aspx

# What does this mean for Delphi?

- Will a black hole open up in my programs?
- Will my 32-bit applications stop working?
- Will I have to change all of my code?
- Will I tear my hair out looking for obscure migration issues?
- Will the world end?

# Don’t panic!

- Quoting from
  “The Hitchhiker’s Guide to the Galaxy”

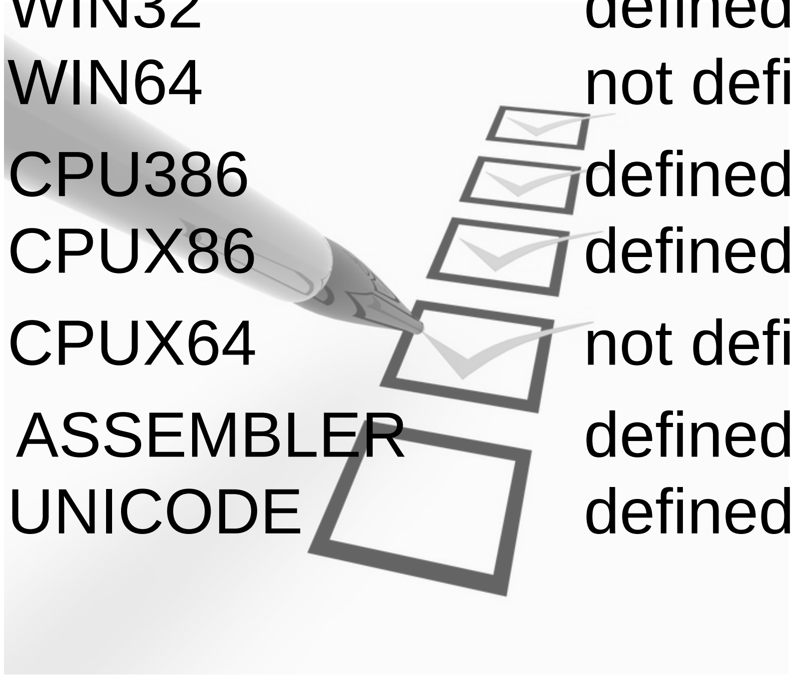
- Don’t Panic
- Delphi/64’s got your code & back covered!

# Delphi 64-bit on Windows

- Same Windows API
  - CreateWindowEx, PeekMessage, etc..
- Same Delphi RTL
  - SysUtils, Classes, Generics.Collections, etc…
- Same VCL
  - Forms, Graphics, Controls, Menus, etc..

# Pre-Defined Conditionals

| Category | Identifier | dcc32 | dcc64 |
|---|---|---|---|
| Compiler | DCC | defined | defined |
| | VER230 | defined | defined |
| Platform | MSWINDOWS | defined | defined |
| | WIN32 | defined | not defined |
| | WIN64 | not defined | defined |
| CPU | CPU386 | defined | not defined |
| | CPUX86 | defined | not defined |
| | CPUX64 | not defined | defined |
| Availability | ASSEMBLER | defined | defined |
| | UNICODE | defined | defined |



# Delphi 64-bit on Windows – some gotcha's

- SizeOf(Pointer) <> SizeOf(Integer)
  - Integer<->Pointer casts will break in 64bit
  - SizeOf(THandle) = SizeOf(Pointer)
  - All Handles = SizeOf(Pointer) (HWND, HDC, etc..).
- All code in process must be 64bit
  - Must have 64bit versions of external non-Delphi libraries (DLLs)
- One, and only one, calling convention
  - **`register,pascal,cdecl,stdcall`** ignored.
- **`safecall`** is still "special"
- Old "pointer math" code may break
  - `Works in 32 and 64bit: MyPtr := PByte(P) + 10;`

# Delphi 64-bit on Windows – some gotcha's

- Inline Assembly
  - Cannot mix **`asm`** blocks with Pascal code
  - Only procedural level **asm** blocks supported
  - Stack **must be 16-byte** aligned at each call instruction
  - Define locals for temp storage
  - Do not modify the RSP stack pointer
  - New unified calling convention. First 4 parameters in registers, RCX, RDX, R8, R9 (or XMM0-XMM3)
- Exception unwinding
  - No change for pure Delphi code. Exceptions function identically.
  - Inline Assembly can cause exception unwinding to fail if not properly written.

# Windows API gotcha’s

- SetWindowLong / GetWindowLog should be replaced by SetWindowLongPtr / GetWindowLongPtr for GWLP_HINSTANCE, GWLP_WNDPROC, etc… as they return pointers and handles.
  - Pointers passed to SetWindowLongPtr should be type-casted to LONG_PTR and not to Integer / Longint.
- SetWindowLong mapped to SetWindowLongPtr in Windows.pas.
  - Calls to our declaration of SetWindowLong are safe, as long as they are cast correctly.

# Windows API gotcha's (con't)

- Use explicit casts to WPARAM and LPARAM where appropriate.
  - Example: Passing pointers through SendMessage

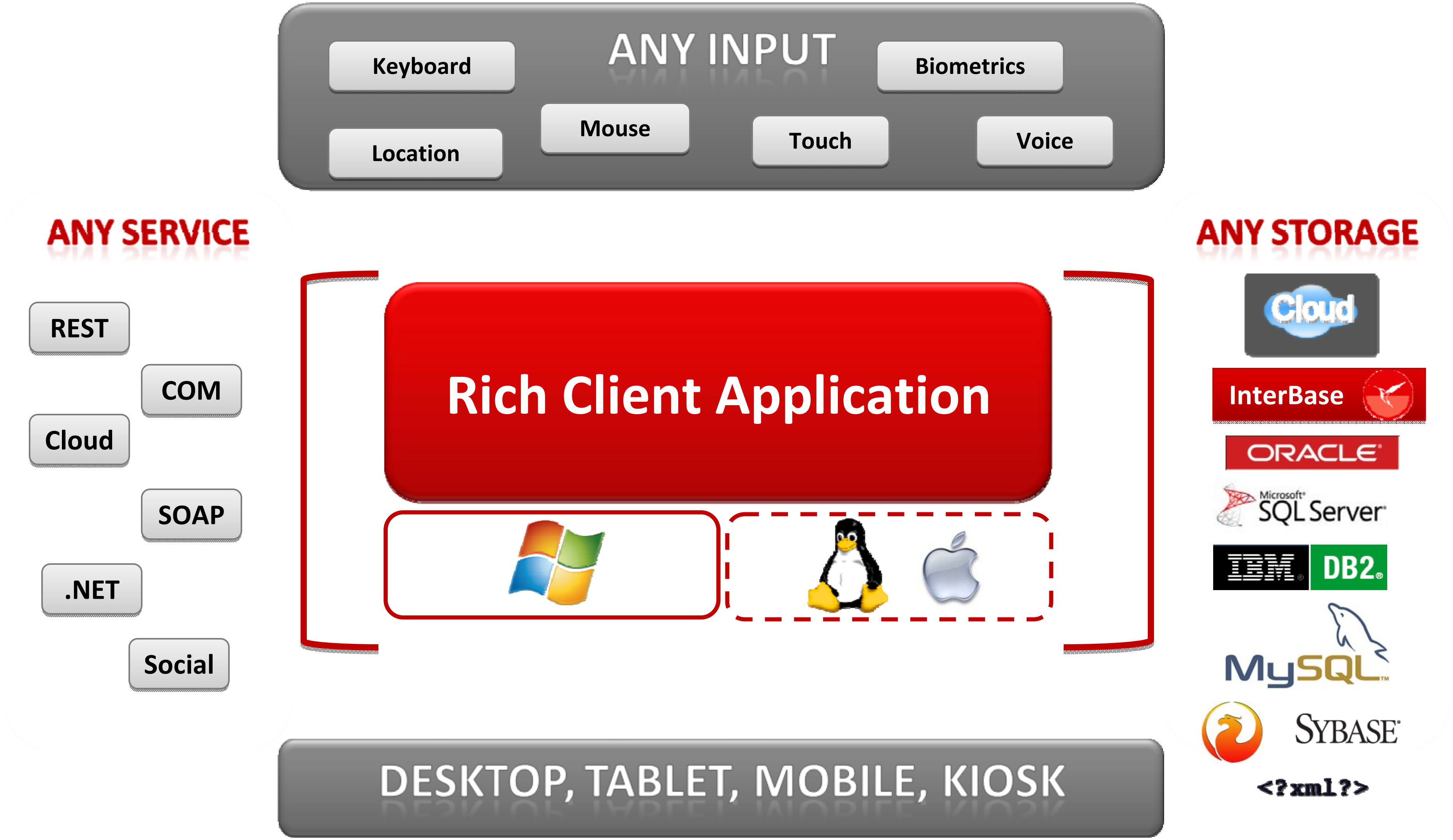
    ```
    SendMessage(hWnd, WM_SETTEXT, 0,
    LPARAM(@MyCharArray));
    ```
- Use LRESULT to cast message results
  - Example: `Message.Result := LRESULT(Self);`
- Message cracker records (TWMxxx) changed
  - Alignment changes and field-size changes

# What can I do today?

- Find all Integer<->Pointer casts, including Integer<->instance casts.
  - Check for Pointer size assumptions
- Ensure external dependencies are also 64bit
  - Image/bitmap libraries
  - Hardware interfaces libraries
  - ActiveX controls
- Consider rewriting Assembler in pure-Pascal
  - Better future portability (think ARM CPUs…)
  - Rely more on algorithmic performance rather than raw assembly performance.

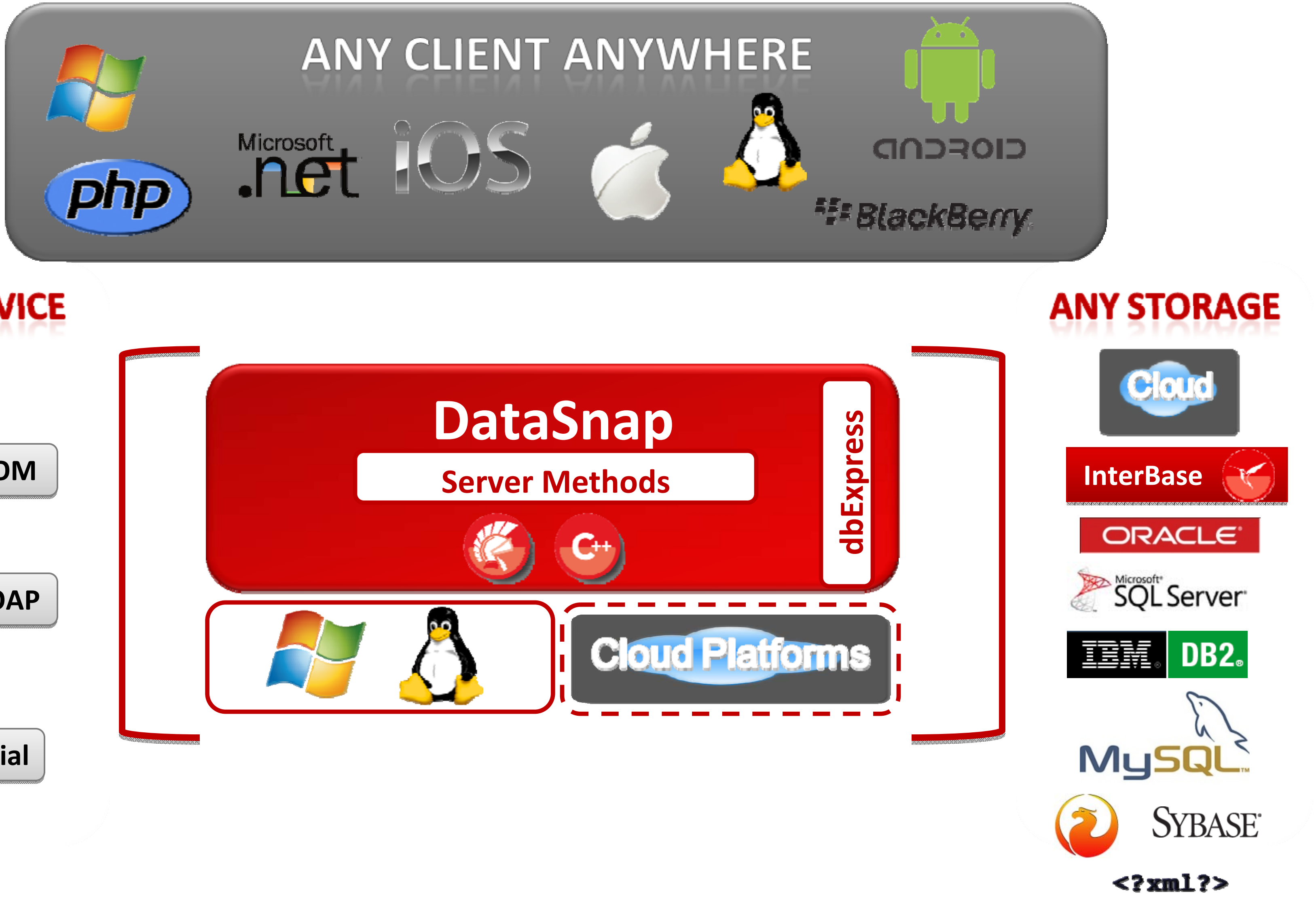
# Delphi 64-bit Demonstration

# RAD Studio Client Vision



embarcadero

# RAD Studio Server Vision



ANY CLIENT ANYWHERE

php

Microsoft .net

iOS

android

BlackBerry

ANY SERVICE

REST

COM

Cloud

SOAP

.NET

Social

DataSnap

Server Methods

dbExpress

Cloud Platforms

ANY STORAGE

Cloud

InterBase

ORACLE

Microsoft SQL Server

IBM DB2

MySQL

SYBASE

<?xml?>

embarcadero

# Q & A

# Thank You ☺

David Intersimone "David I"
VP of Developer Relations and Chief Evangelist
davidi@embarcadero.com
http://blogs.embarcadero.com/davidi
Twitter:  davidi99
Skype: davidi99