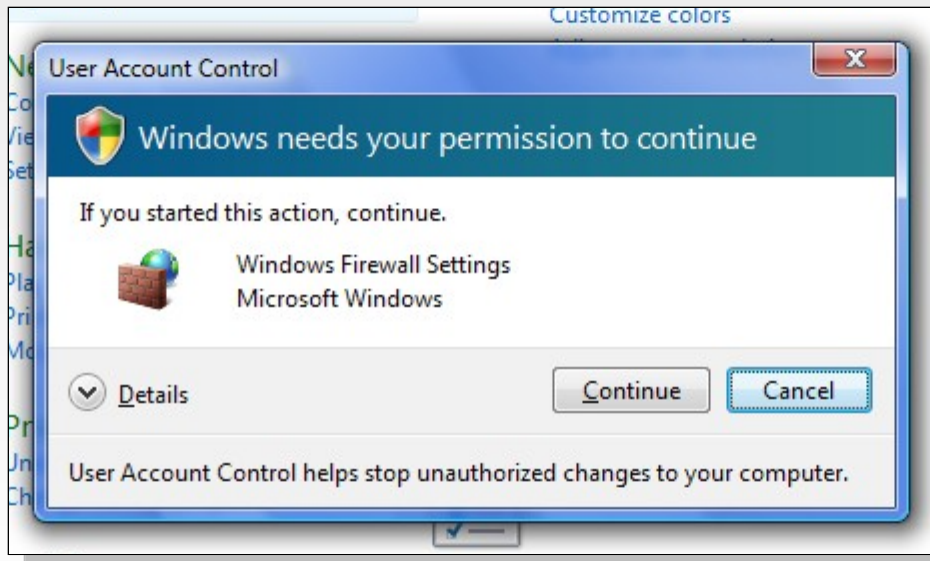


Windows Vista User Account Control (UAC) and Delphi

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User Account Control (UAC)

- Security token split during logon
 - one **user token** and one **admin token**
- Administrator shell run with **Standard User** token
- You have to explicitly consent every time you create a process with administrator token – this is called “elevation”



Standard User – Over the shoulder elevation

The screenshot shows a Windows Explorer window with a file list and a User Account Control (UAC) dialog box. The file list includes:

File Name	Created	Type	Size
TestAsInvoker	2006-12-07 08:03	Application	508
TestHighestAvailable	2006-12-07 08:03	Application	508
TestPlain	2006-12-07 08:03	Application	507
TestRequireAdministrator	2006-12-07 08:03	Application	508
TestSettings	2006-12-20 15:18	Configuration Sett...	1
TestWinXP	2006-12-07 08:03	Application	508

The UAC dialog box displays the following information:

- Title:** User Account Control
- Message:** An unidentified program wants access to your computer
- Warning:** Don't run the program unless you know where it's from or you've used it before.
- Program:** TestRequireAdministrator.exe, Unidentified Publisher
- Action:** To continue, type an administrator password, and then click OK.
- User:** fflaglund
- Input:** Password field (containing 'password')
- Error:** Logon failure: unknown user name or bad password.
- Buttons:** Details, OK, Cancel
- Footer:** User Account Control helps stop unauthorized changes to your computer.

Windows Vista

- UAC is Enabled by Default
- All Subsequent User Accounts are Created as Standard Users
- Elevation Prompts are Displayed on the Secure Desktop by Default
- Elevation Prompts for Background Applications are Minimized to the Taskbar
- Elevations are blocked in the User's Logon Path
- Built-in Administrator Account is Disabled by Default on New Installations
- New Default Access Control List (ACL) Settings

Standard User

- All processes are started as Standard User as default
- A Standard User can not
 - Change files in **Program Files** folders
 - Change files in **Windows** or **System32** folders
 - Change registry under **HKLM\Software**
 - Change the local machines **date and time**
 - Install or uninstall **Services**
 - ...
- Earlier strong Recommendations are now enforced!

New Technologies for Windows Vista

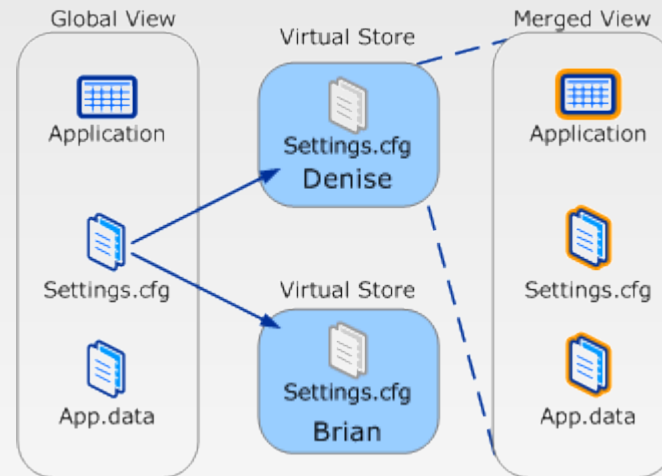
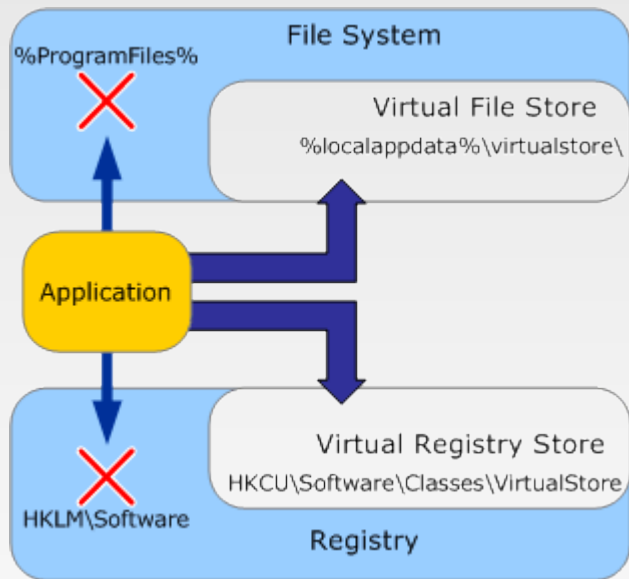
- Installer Detection
- User Interface Privilege Isolation
- Virtualization
- Access Token Split during login
- Secure Desktop

User Interface Privilege Isolation

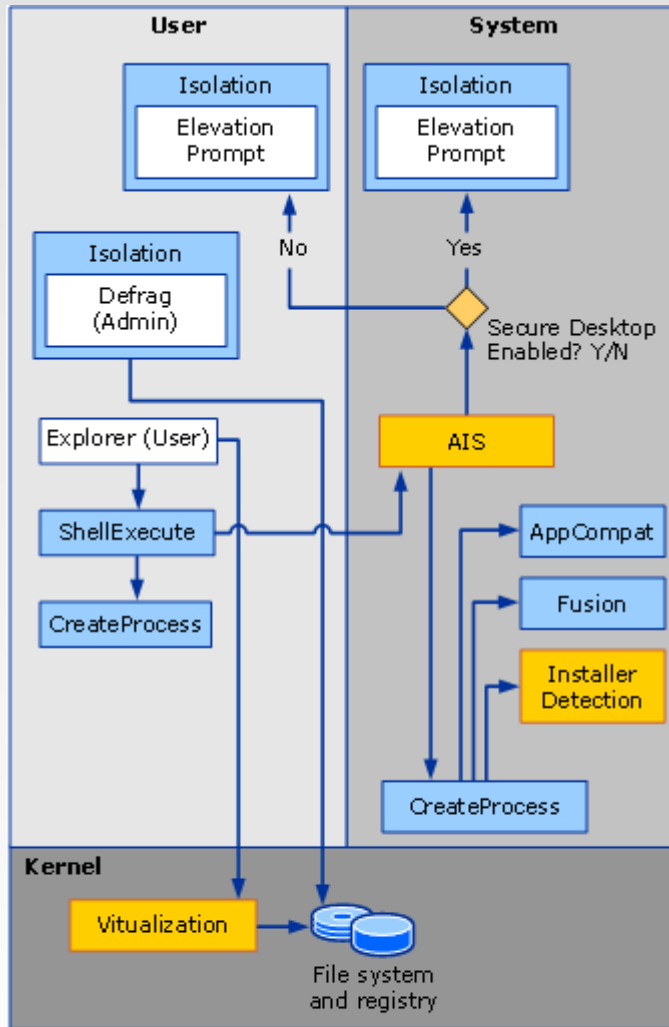
- General guideline – “lower” can not access “higher”
- A lower privilege process cannot:
 - Perform a window handle validation
 - SendMessage or PostMessage
 - Use thread hooks to attach
 - Use Journal hooks to monitor
 - Perform dynamic link-library (DLL) injection
- Some resources are still shared between processes
 - Desktop window, which actually owns the screen surface
 - Desktop heap read-only shared memory
 - Global atom table
 - Clipboard

Virtualization / Redirection

- Virtualization is for compatibility – not a feature
- Disabled for executables with UAC info in manifest!



UAC Architecture

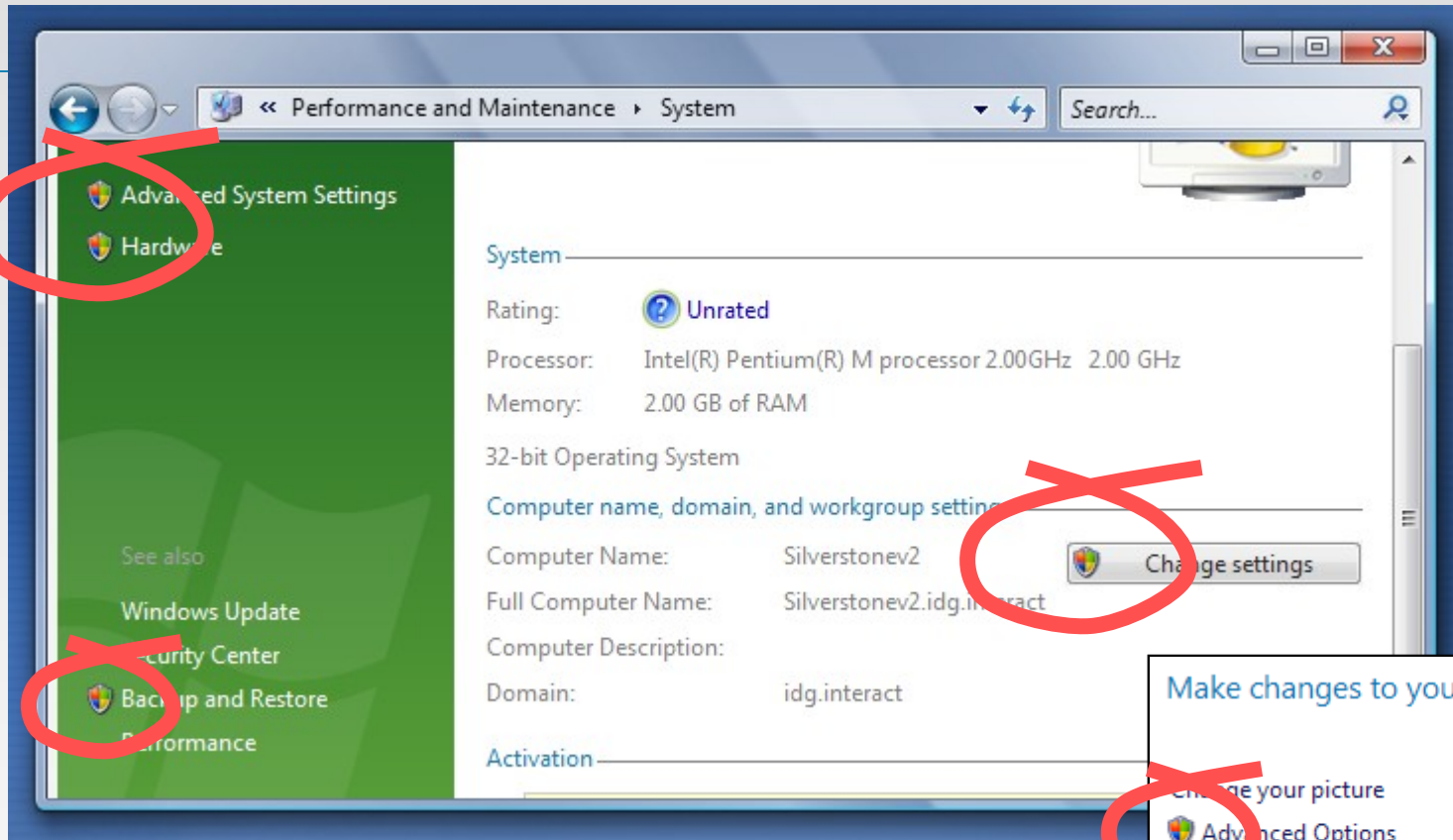


The Shield




- Attached to controls which, if clicked, will require elevation as the next step
- Has only one state (I.e. no hover, disabled etc.)
- Does not remember elevated state
 - *Not* an unlock operation

Shield UI Examples



Make changes to your user account

Change your picture  ian

[Advanced Options](#)

To change your password, press
Ctrl+Alt+Del and select Change a
Password...

Delphi – What you have to do...

- Test your application – identify problems
- Classify your application as Standard User, Admin or Mixed.
- Add application Manifest
- Redesign functionality
 - User apps should write data to correct locations
 - Split out admin stuff into a separate executable
- Redesign user interface
 - Add shield to buttons
- Redesign installer
- Test again
- Optionally sign application (Authenticode)
- Determine whether to pursue the Windows Vista Logo program

Test with Standard User Analyzer Tool

- SUA helps you find what you do that can break application

Standard User Analyzer

File View Options Help

App Info File Registry INI Token Privilege Name Space Other Objects Process

Log File: C:\Users\vhaglund\AppData\Local\Temp\sua

Target Application: C:\Program Files_Test Application\TestWinXP.exe

Parameters:

Symbols Path: C:\Windows

Runtime Diagnosis Refresh Log

Launch Elevated

Debug Info

Launching : C:\Program Files_Test Application\TestWinXP.exe
WorkingDir: C:\Program Files_Test Application
Returned : 0

Executing: appverif.exe -disable luapriv for "TestWinXP.exe"
Returned : 0

Time	StopCode	Severity	Message
2006-12-20 : 15:17:58	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:17:58	0x3326	Error	The application performed a hard administrator ch...
2006-12-20 : 15:17:58	0x3326	Error	The application performed a hard administrator ch...
2006-12-20 : 15:17:58	0x3326	Error	The application performed a hard administrator ch...
2006-12-20 : 15:18:11	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:18:11	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:18:11	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:18:11	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:18:11	0x3328	Error	The application called a WriteProfile API with LUA...
2006-12-20 : 15:18:16	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:18:16	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:18:16	0x331B	Error	Access was restricted to trusted users only.
2006-12-20 : 15:18:16	0x331B	Error	Access was restricted to trusted users only.

Detailed Information

WritePrivateProfileStringA: File (\Device\HarddiskVolume1\Program Files_Test Application\TestSettings.ini) only grants requested 'FILE_WRITE_DATA' to 'NT AUTHORITY\SYSTEM, BUILTIN\Administrators'

Stack Trace

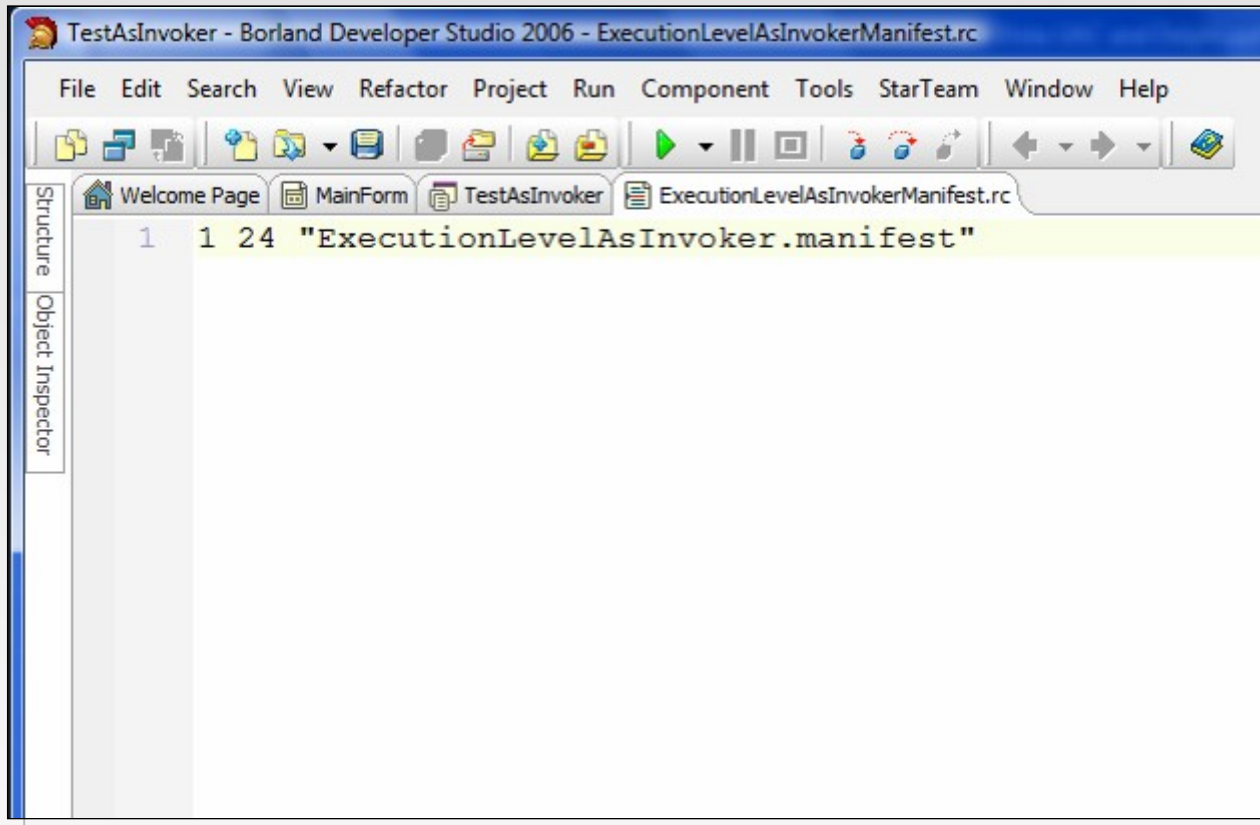
vfuapriv2!DllUnregisterServer+298d
vfuapriv2!DllUnregisterServer+2ede
vfuapriv2!DllUnregisterServer+307e
vfuapriv2!DllUnregisterServer+3141
vfuapriv2!DllUnregisterServer+31d1
vfuapriv2!DllUnregisterServer+3300
vfuapriv2!DllUnregisterServer+cf72
vfuapriv2!DllUnregisterServer+d189
vfuapriv2!DllUnregisterServer+d1ec
vfuapriv2!DllUnregisterServer+493a
TestWinXP!+41ef96
TestWinXP!+46a5b2
TestWinXP!+4435b6
TestWinXP!+448f06

Requested Execution Level in Delphi

- NB! Remove all references to XPMan unit from project!!!

```
program TestAsInvoker;  
  
{$R 'ExecutionLevelAsInvokerManifest.res' 'ExecutionLevelAsInvokerManifest.rc'}  
  
uses  
    Forms,  
    MainForm in '..\Common\MainForm.pas' {Form2};  
  
{$R *.res}  
  
begin  
    Application.Initialize;  
    Application.CreateForm(TForm2, Form2);  
    Application.Run;  
end.
```

RC-file is compiled to RES-file



Manifest

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<assembly xmlns="urn:schemas-microsoft-com:asm.v1" manifestVersion="1.0">
  <dependency>
    <dependentAssembly>
      <assemblyIdentity
        type="win32"
        name="Microsoft.Windows.Common-Controls"
        version="6.0.0.0"
        publicKeyToken="6595b64144ccf1df"
        language="*"
        processorArchitecture="x86" />
    </dependentAssembly>
  </dependency>

  <trustInfo xmlns="urn:schemas-microsoft-com:asm.v2">
    <security>
      <requestedPrivileges>
        <requestedExecutionLevel
          level="asInvoker"/>
      </requestedPrivileges>
    </security>
  </trustInfo>
</assembly>
```


<requiredExecutionLevel />

- level="asInvoker"
 - Start process running with same token as the process creating it.
- level="highestAvailable"
 - Ask administrators for consent to elevate but start as standard user if user has no administrative privileges
- level="requireAdministrator"
 - Ask administrators for consent to elevate.
 - Standard user will get login dialog for over the shoulder support
 - Will only start with administrative privileges

Windows XP Warning!

- Incorrect formatting of Manifest can **blue screen** Windows XP
- Read KB921337

Redesign

- Do not open files or registry keys with Write flag
- Save data, log files, etc. in the right location using SHGetFolderPath
 - CSIDL_PERSONAL { My Documents }
 - CSIDL_APPDATA { Application Data, new for NT4 }
 - CSIDL_LOCAL_APPDATA { non roaming, user\Local Settings\Application Data }
 - CSIDL_COMMON_APPDATA { All Users\Application Data }
 - CSIDL_MYPICTURES { My Pictures, new for Win2K }
 - CSIDL_COMMON_DOCUMENTS { All Users\Documents }
 - ...

SHGetFolderPath

```
uses
  SHFolder;

function GetFolder(csidl: Integer; ForceFolder: Boolean = False): string;
var
  i: Integer;
begin
  SetLength(Result, MAX_PATH);
  if ForceFolder then
    SHGetFolderPath(0, csidl or CSIDL_FLAG_CREATE, 0, 0, PChar(Result))
  else
    SHGetFolderPath(0, csidl, 0, 0, PChar(Result));
  i:= pos(#0, Result);
  if i > 0 then
    SetLength(Result, Pred(i));
end;

function GetLocalAppDataFolder(ForceFolder: Boolean = False): string;
begin
  Result:= GetFolder(CSIDL_LOCAL_APPDATA, ForceFolder);
end;
```

RunAsAdmin

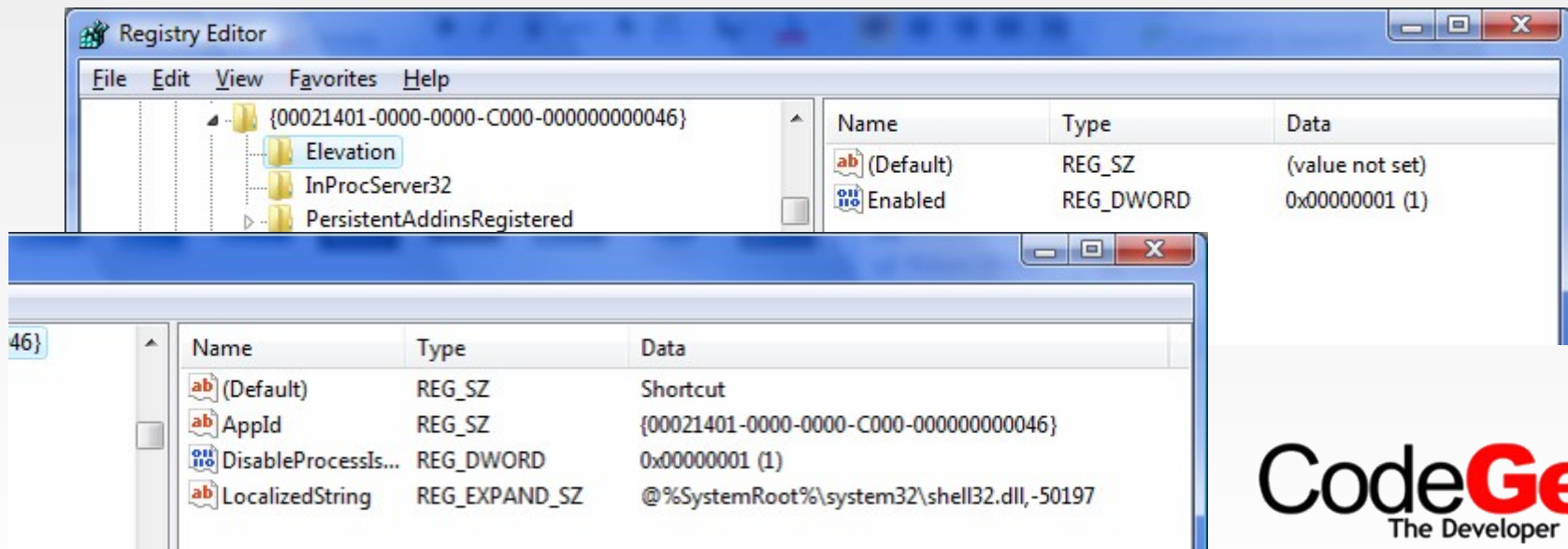
- Launch application running as administrator
- Use Application.Handle to delay elevation if app is minimized.
- No handle always gives direct foreground elevation.

```
// Vista Utilities

procedure RunAsAdmin(hWnd: HWND; aFile: string; aParameters: string);
var
    sei: TShellExecuteInfoA;
begin
    FillChar(sei, SizeOf(sei), 0);
    sei.cbSize := sizeof(sei);
    sei.Wnd := hWnd;
    sei.fMask := SEE_MASK_FLAG_DDEWAIT or SEE_MASK_FLAG_NO_UI;
    sei.lpVerb := 'runas';
    sei.lpFile := PChar(aFile);
    sei.lpParameters := PChar(aParameters);
    sei.nShow := SW_SHOWNORMAL;
    if not ShellExecuteEx(@sei) then
        RaiseLastOSError;
end;
```

Using COM class for Admin tasks

- COM Server must be an EXE
- EXE must have requireAdministrator to install COM objects correctly
- Registration of COM Class must
 - add value LocalizedString (and resource string in executable)
 - add key Elevation and value Enabled = 1



Elevated COM calls

- Use Moniker to create elevated CoClass from User Process

```
function NewCoGetObject(pazName: PWideChar; pBindOptions: PBindOpts3;
    const iid: TIID; out ppv): HRESULT; stdcall; external
'ole32.dll'
    name 'CoGetObject';

function CoCreateInstanceAsAdmin(WndHandle: HWND; clsid: TCLSID;
    iid: TIID; out ppv): HRESULT;
var
    Bo      : TBindOpts3;
    Moniker : PWideChar;
begin
    Moniker := PWideChar(WideString('Elevation:Administrator!new:' +
        GuidToString(clsid)));

    FillChar(Bo, SizeOf(Bo), #0);
    Bo.hwnd      := WndHandle;
    Bo.cbStruct  := SizeOf(Bo);
    Bo.dwClassContext := CLSCTX_LOCAL_SERVER;
    Result      := NewCoGetObject(Moniker, @Bo, iid, ppv);
end;
```

The Shield - SetElevationRequiredState

- Call function with Button as parameter to add Shield symbol

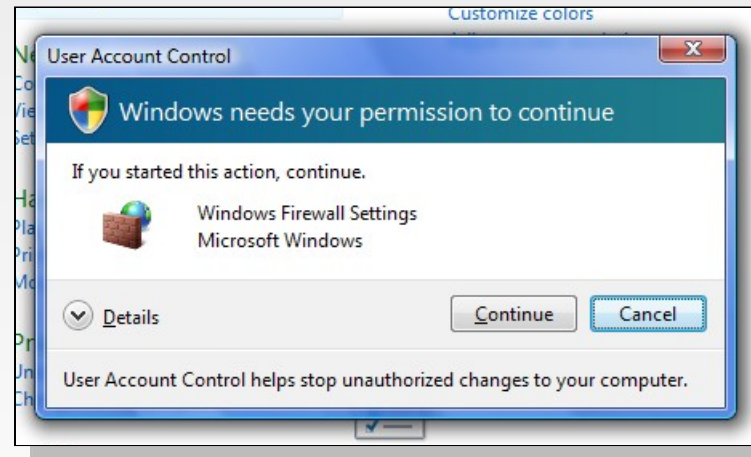
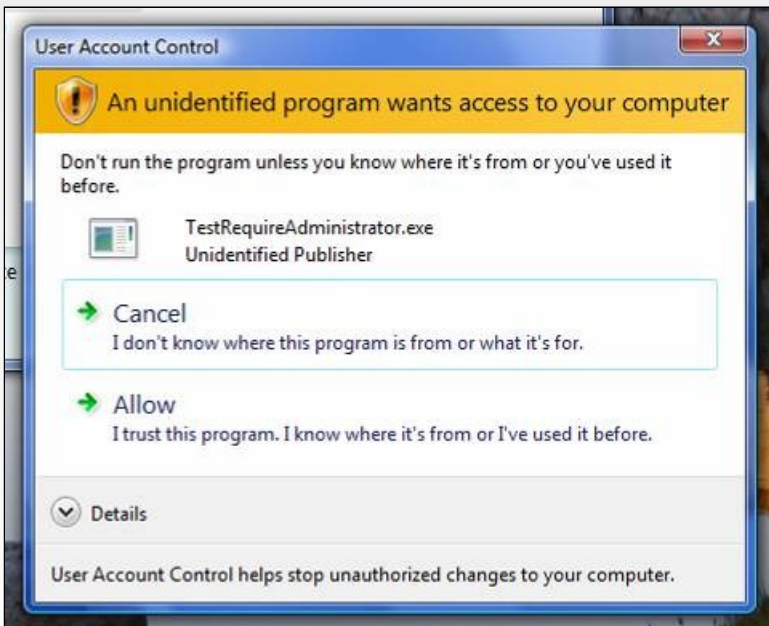
```
const
  BCM_FIRST = $1600; // Button control messages
  BCM_SETSHIELD = BCM_FIRST + $000C;

procedure SetElevationRequiredState(aControl: TWinControl; Required: Boolean);
var
  lRequired: Integer;
begin
  lRequired := Integer(Required);
  SendMessage(aControl.Handle, BCM_SETSHIELD, 0, lRequired);
end;
```



Sign with Authenticode

- Get less serious looking consent dialog
- Register at winqual.microsoft.com
- Buy certificate (Verisign, etc.)
- Sign executables (MakeCert, Signtool.exe)
- Register applications at winqual to get access to crash logs



Resources

- **Document**
 - **Windows Vista Application Development Requirements for User Account Control Compatibility**
- **Tool**
 - **Microsoft Standard User Analyzer**
- **Windows Vista Logo Program**
 - **<http://microsoft.mrmplc.com/InnovateOnWindowsVista/>**

Thank you! 😊