Embarcadero Conference

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Internet of Things:
Bluetooth, App Tethering & Gadgets

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You are Developers of Things, Everything!

About Jim McKeeth

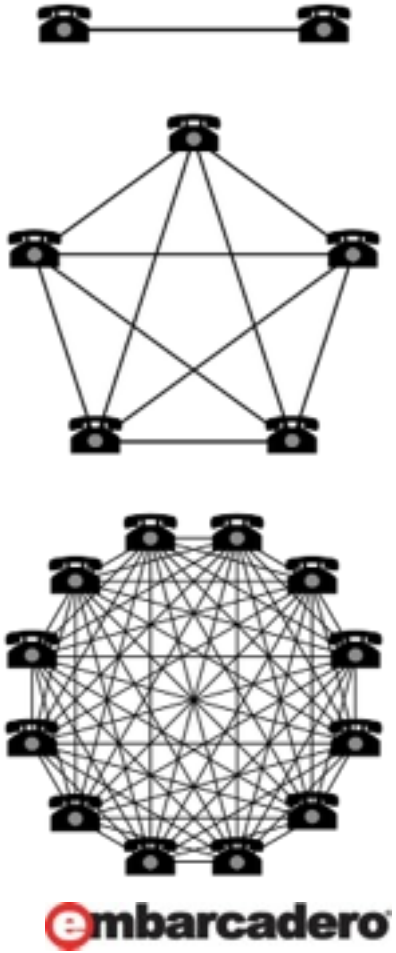
- Lead World Wide Developer Evangelist
- Manage the Embarcadero MVP Program
- Host of Podcast at Delphi.org
- Longtime developer
  - Object Pascal, Java, C#, JavaScript, Objective-C, etc.
- Invented and patented swipe to unlock in 2000
  - US Patent # 8352745 & 6766456, etc.
- Improvisational performer

What is the *Internet of Things?*

- Where everyday objects send and receive data online.

Product images, Wikimedia Commons, Pixabay, etc.

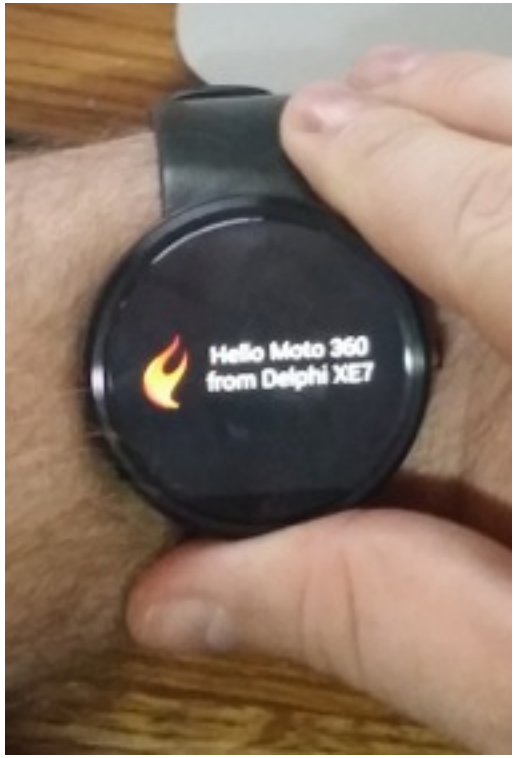
Internet of Things & Metcalfe's Law

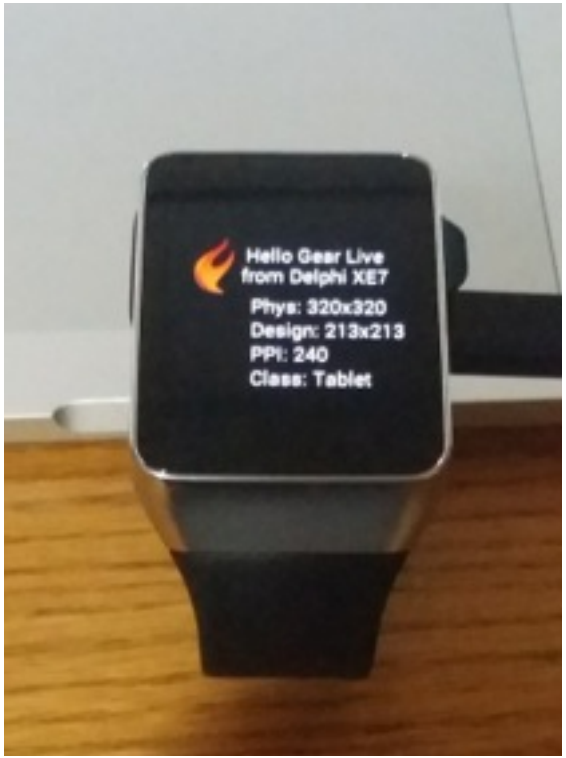


Metcalfe's law states that the value of a network is proportional to the square of the number of connections in the system (n^2).

So the more "things" we add, the more value the internet provides.

Multi-Device Designer & Wearable Devices





Demonstration

Designing for Wearables

Multi-Device Designer Custom View Resources

- Moto 360 and Galaxy Gear Live views
  - http://delphi.org/2014/09/hello-moto-360-from-delphi-xe7/
- DocWiki on Customized Views
  - http://docwiki.embarcadero.com/RADStudio/XE7/en/Adding_a_Customized_View_to_the_View_Selector

App Tethering

- Easily expand your apps to mobile devices.
- Mobile companion apps are the answer for Windows VCL apps.
- Control and interact with existing Windows apps from mobile apps.
- Simple communication components on each side.
- Connect over WiFi, TCP/IP or Bluetooth.
- For example, sending photos from Google Glass to existing Windows application.

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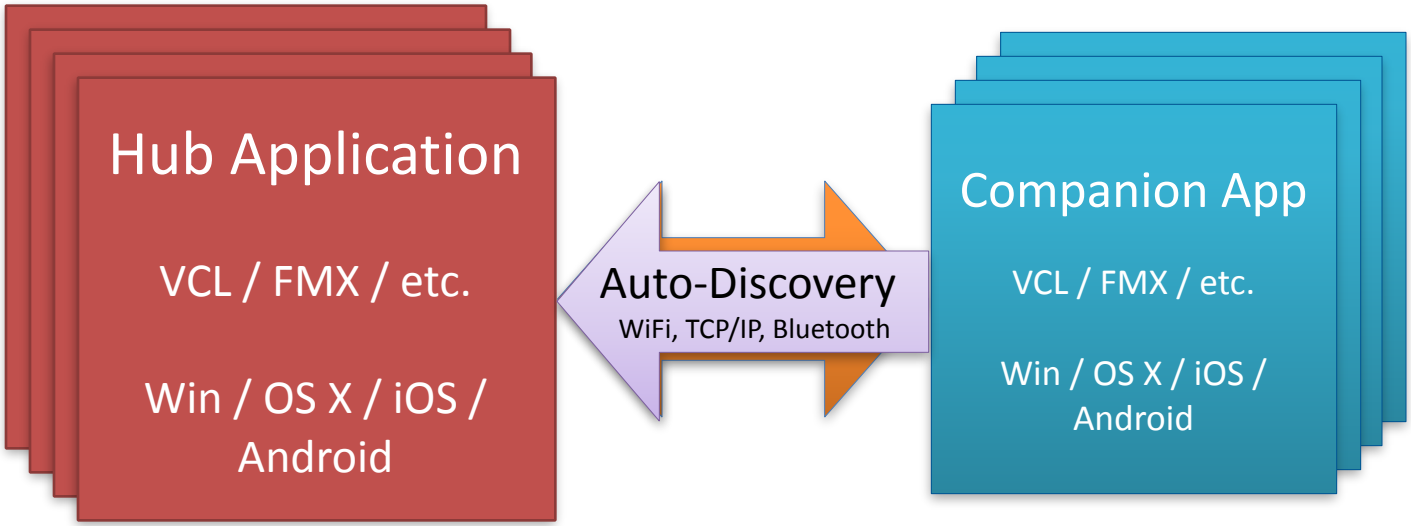
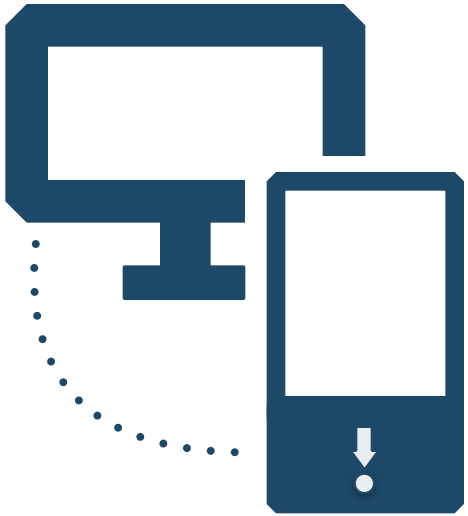
App Tethering



Bi-Directional — Many-to-Many — Peer-to-Peer

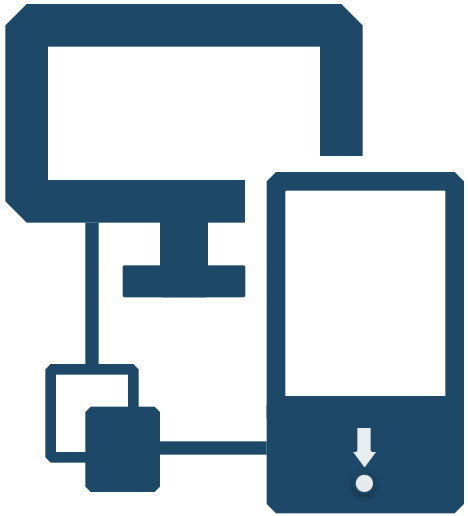
TTetheringManager

- Each app has one Tethering Manager component.
- Performs Auto Discovery.
- It manages the pairing and connection with other managers.
- Handles authentication.



TTetheringAppProfile

- Each app has one or more more Tethering App Profile components.
- Publishes app actions for remote execution.
- Runs remote actions.
- Sends data to, and receives data from remote app.



Tethering Usage

- Bidirectional invoking actions.
  - Providing a second portable screen.
  - Remote button clicks and events.
- Sending strings and streams.
  - Barcode scanner, voice recognition, touch screen input, capturing pictures or sensor data.
- Expanding your application's reach.

Demonstration

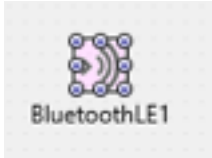
App Tethering

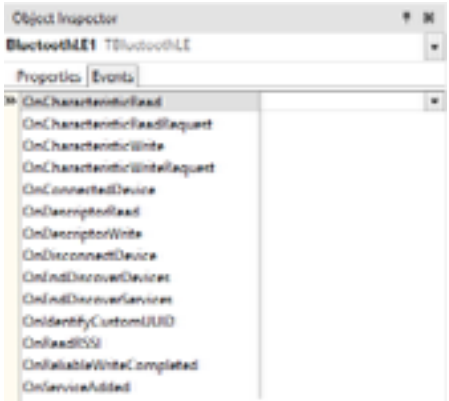
More Tethering Information

- Using App Tethering in the DocWiki
  - http://docwiki.embarcadero.com/RADStudio/en/Using_App_Tethering
- Shipping Samples
  - C:\Users\Public\Documents\Embarcadero\Studio\15.0\Samples\Object Pascal\RTL\Tethering
  - Update from SourceForge SVN for latest samples!

Bluetooth Support - New in XE7

- RTL new unit: System.Bluetooth
- Multi-device API for Classic Bluetooth & Bluetooth LE
- TBluetoothLE component
- Classic Bluetooth classes
  - TBluetoothManager
  - TBluetoothAdapter
  - TBluetoothDevice





Platform	App tethering	RTL API		
	IP	Classic Bluetooth	Bluetooth Low Energy	
			Client	Server
Windows	✓	✓	8+	
Mac OS X	✓	✓	✓	10.9+
iOS	✓		5+	6+
Android	✓	✓	4.3+	

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Bluetooth and App Tethering

- To implement Classic Bluetooth support in your VCL and FMX apps:
  - Obtain an instance of TBluetoothManager.
  - Discover remote devices and pair with them.
  - Connect to the paired devices.
  - Exchange data with the connected devices.

BluetoothLE and Devices

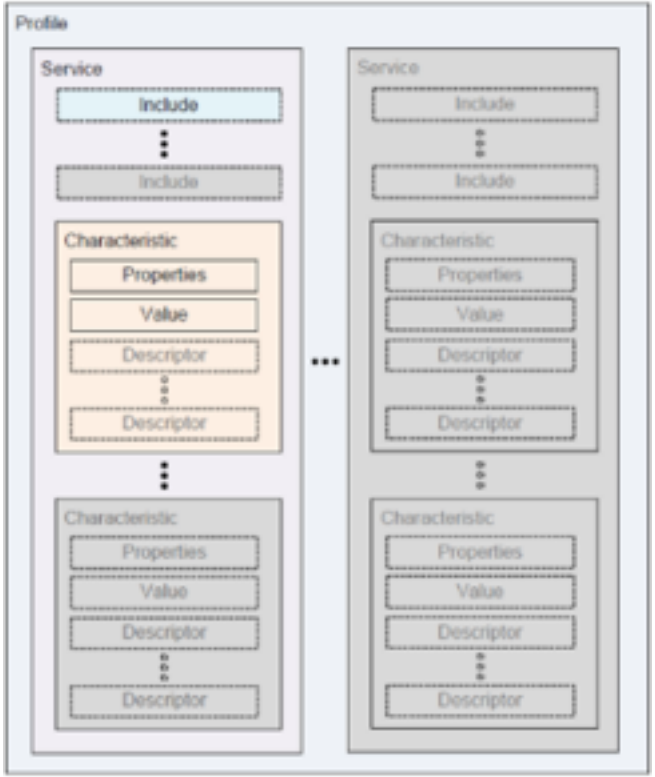
- Use an instance of **TBluetoothLEDevice** to:
  - Discover services that the remote device provides
  - Obtain detailed info including the characteristics
    - Read and Write a characteristic value
    - Ask to be notified of changes in a Characteristic value
      - SetCharacteristicNotification method
      - OnCharacteristicRead event handler
    - Get the received signal strength indicator (RSSI)
- To obtain an instance of **TBluetoothLEDevice**
  - Use the StartDiscovery method or LastDiscoveredDevices property

Different Types of Bluetooth

- Classic Bluetooth (Legacy Bluetooth)
  - Higher bandwidth & range
  - Audio and video transfer
- Bluetooth Smart / Low Energy / LE
  - Uses less power over less range and more devices
  - Pairing is optional
  - Uses GATT profiles

BluetoothLE GATT-based Profile Hierarchy

- Generic Attribute Profile (GATT)
  - Services are collections of characteristics and relationships to other services that encapsulate the behavior of part of a device
  - https://developer.bluetooth.org/gatt/Pages/GATT-Specification-Documents.aspx
- If device is not GATT
  - Try using discovery
  - Contact the device manufacturer



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Demonstration

Bluetooth Devices

Bluetooth Resources

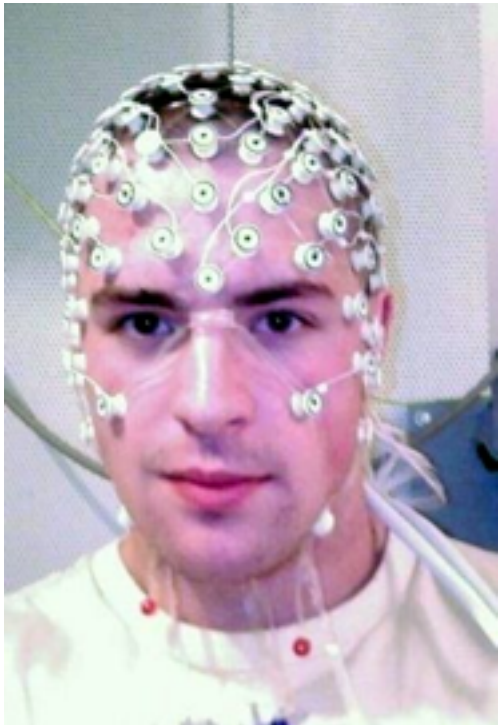
- Bluetooth samples that are included in XE7
  - C:\Users\Public\Documents\Embarcadero\Studio\15.0\Samples\Object Pascal\
    - ..\Mobile Samples\Device Sensors and Services\Bluetooth
    - ..\RTL\Tethering
- Bluetooth and App Tethering
  - http://docwiki.embarcadero.com/RADStudio/XE7/en/Using_Bluetooth
  - http://docwiki.embarcadero.com/RADStudio/XE7/en/Using_Classic_Bluetooth
  - http://docwiki.embarcadero.com/RADStudio/XE7/en/Using_App_Tethering
- Bluetooth.org
  - https://developer.bluetooth.org/TechnologyOverview/Pages/BLE.aspx
  - https://developer.bluetooth.org/TechnologyOverview/Pages/GATT.aspx
  - https://developer.bluetooth.org/gatt/Pages/GATT-Specification-Documents.aspx
  - https://developer.bluetooth.org/gatt/services/Pages/ServicesHome.aspx

Brain-Computer Interface

ST:TNG Episode 93 (4x19): The Nth Degree (1991)

Electroencephalography (EEG)

- Measures electrical activity along the scalp.
- Detects voltage fluctuations resulting from ionic current flows within neurons of brain.
- Millisecond-range resolution (faster than CT or MRI)
- Typical clinical usage has 19+ input electrodes as well as ground and reference.
- Invented between 1875 and 1924



Emotiv EPOC

- 16 wet electrodes
  - 14 EEG – read brain waves
    + 2 reference electrodes
- Two-axis gyroscope to read head movements
- 4 mental states, 13 conscious thoughts & facial expressions – 4 Processing suites
- $399 desktop or $499 for Bluetooth Smart (mobile)
- www.emotiv.com

Expressiv Suite

- Detect facial expressions
  - Eyelid & eyebrow positions
    - Wink, blink, furrow
  - Horizontal eye movement
  - Smile, laugh, clenching & smirking
- EEG sensors picking up signals to muscles (not brain waves)
- Very fast (10ms)

Affectiv Suite

- Detect emotions / mental states
  - Excitement
  - Engagement / Boredom
  - Meditation
  - Frustration
- Passive detection
- Variable levels of each
- Short & long term tracking

Cognitiv Suite

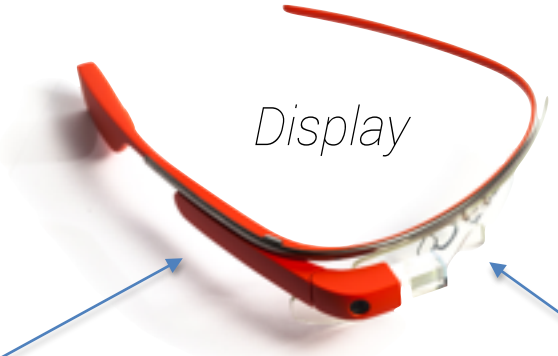
- Detect conscious thoughts
  - Requires training
- Detect 13 thought patterns (4 at a time)
  - 6 Movements: Left, right, up, down, forward, pull
  - 6 Turns: CW, CCW, left, right, sway-back, sway-forward
  - 1 Visualization: Disappear
- Not as fast as Expresiv

Putting It All Together

Emotiv EPOC
Brain-Computer Interface

Input

Display



Google Glass
Wearable Computer

Parrot.AR Drone 2
Simi-Autonomous

Output

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Demonstration

Brain-Controlled Drone

More Information

- Email: jim.mckeeth@embarcadero.com
- Emotiv EPOC: www.emotiv.com
- Parrot AR.Drone: projects.ardrone.org
- My blog: delphi.org
- Full Slide Deck: http://www.slideshare.net/jimmckeeth/jim-mc-keeth-wearable-thought-input
- Code: https://github.com/jimmckeeth/Delphi-Emotiv-EPOC