

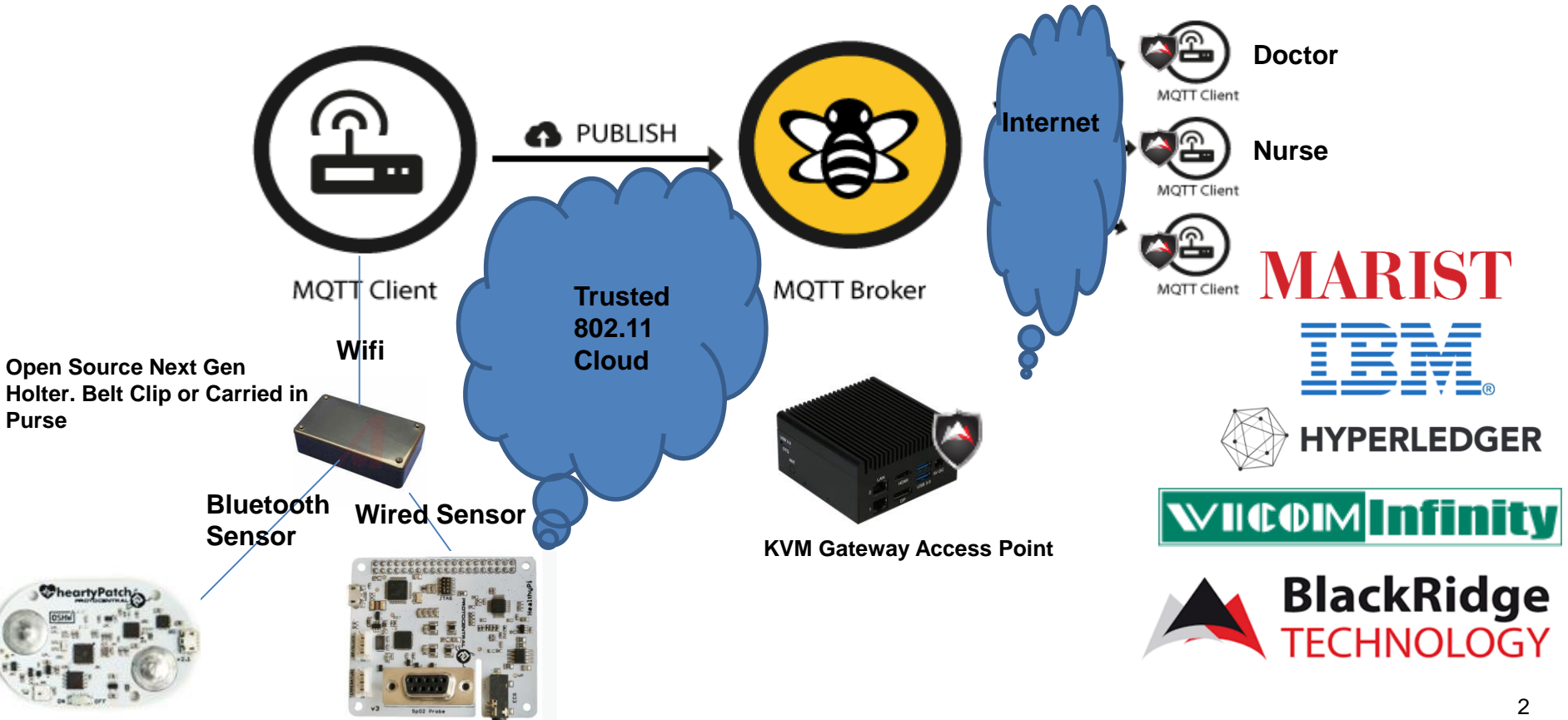
Securing IOT for Blockchain-based Healthcare

2018 ECC Conference at Marist College
Tony Sager, CTO Commercial Markets

June 18, 2018



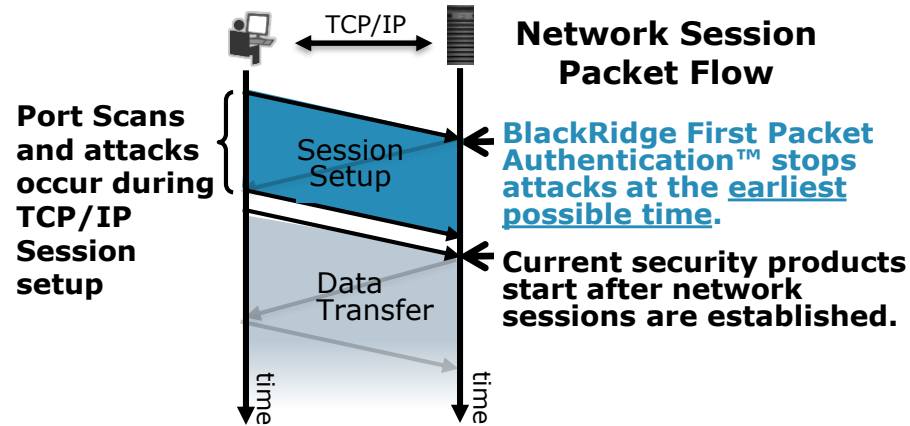
BlackRidge
TECHNOLOGY





BlackRidge Stops Network-based Attacks and Addresses Network Compliance

- BlackRidge addresses the TCP/IP network vulnerability that is exploited in 100% of cyber attacks
 - BlackRidge authenticates identity and enforces security policy on the first packet, before a network session is established
- BlackRidge isolates and protects servers and applications
 - Stops port scans and network attacks
 - Provides ROI and reduces risk
 - Addresses network segmentation compliance



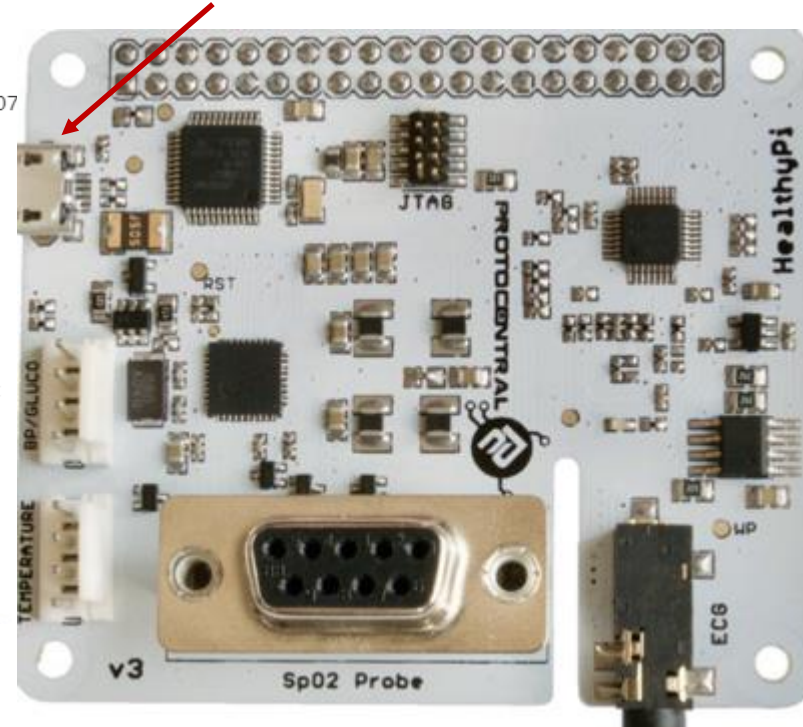
**BlackRidge is like
"Caller ID for the Internet."**

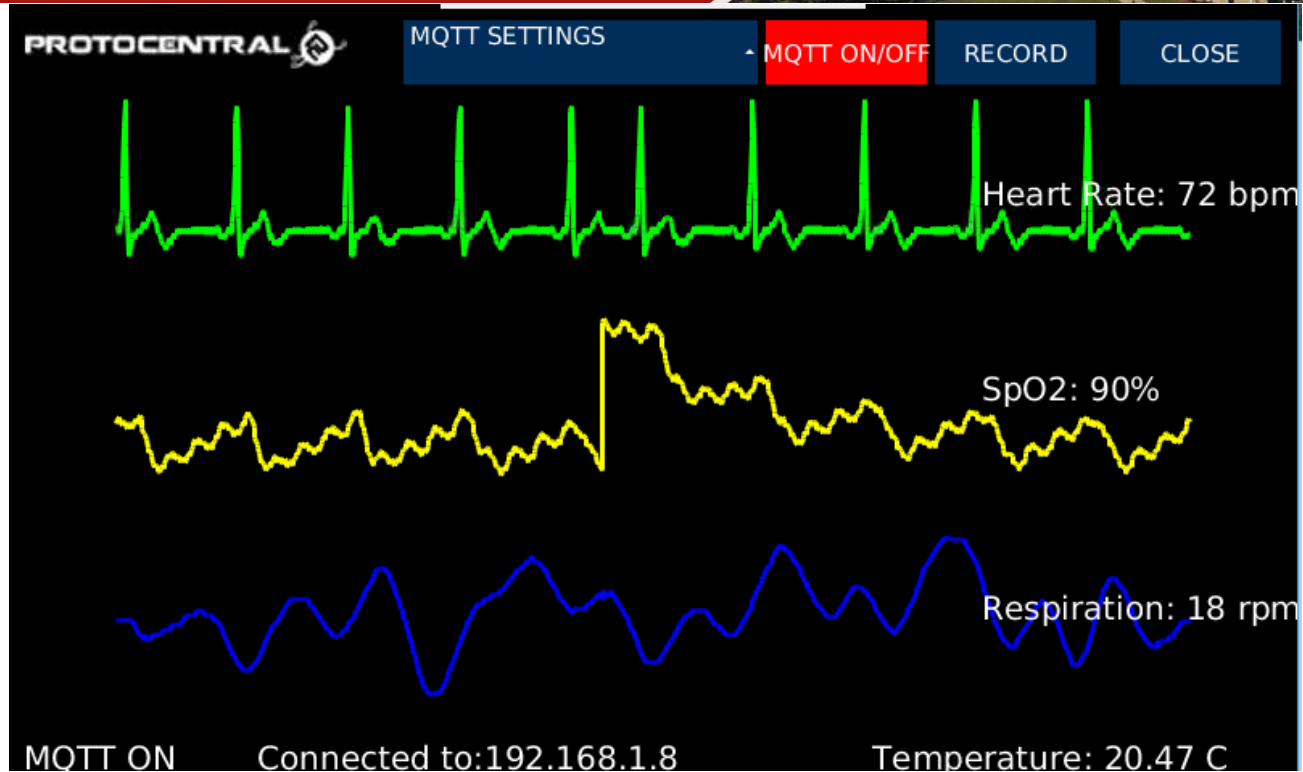


HealthyPi board now streams the same data on the on-board USB port. This allows you to get the same data that goes to the Raspberry Pi on your desktop PC as well.

Technical Specifications

- **ECG and respiration front-End:** Uses the TI ADS1292R 24-bit analog front-end with SNR of 107 dB
- **Pulse oximetry:** Uses TI AFE4400 Pulse Oximetry front-end with integrated LED driver and 22-bit ADC
- **Temperature:** Uses Maxim MAX30205 digital body temperature sensor for skin temperature sensing
- **Main microcontroller:** Atmel ATSAMD21 ARM Cortex M0 - compatible with Arduino Zero
- **Programmability:** Arduino Zero Bootloader preloaded
- **Interfaces:** Raspberry Pi 40-pin header (UART pins connected), USB CDC device, extra UART connector provided for connecting an external blood pressure module
- **IoT functionality:** Can use the Raspberry Pi's Wi-Fi interface to communicate with a TCP client for telemedicine applications or using an MQTT client for continuous logging applications
- **GUI Compatibility:** Uses processing Java-mode (compiles on MacOS/Windows/Linux/Linux-ARM platforms)
- **Firmware compatibility:** Compiles with Arduino or Atmel Studio
- **Dimensions (board only):** 65 mm x 56.5 mm x 6 mm
- **Weight:** 100 g







heartyPatch Bluetooth / WIFI Heart Monitor

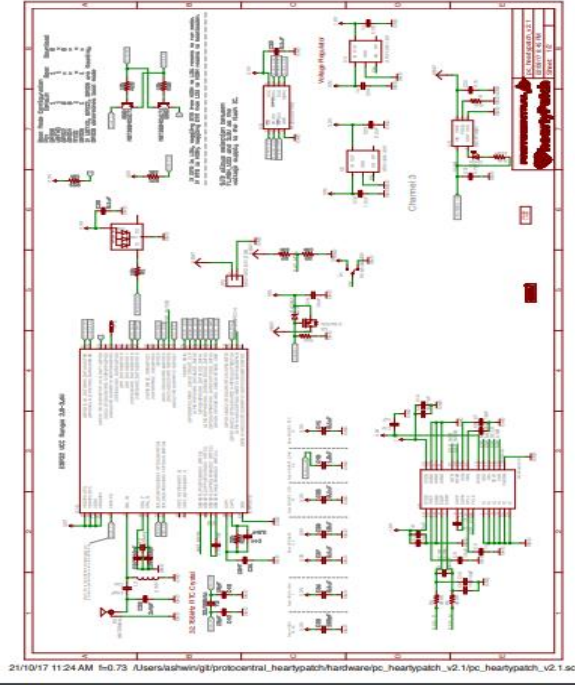


Technical Specifications:

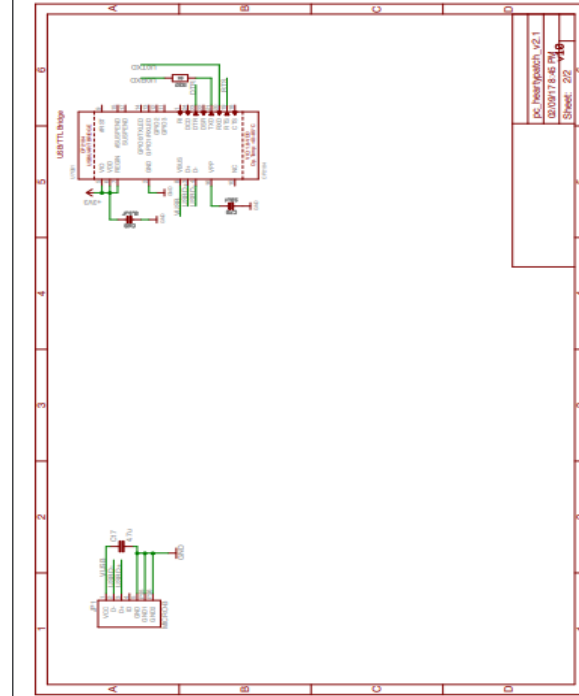
- **Main Microcontroller:** ESP32 SoC with two-core CPU and Wi-Fi/Bluetooth
- **Maxim MAX30003:** analog front-end for ECG
- **Onboard Snap-on Buttons:** connectors for disposable electrode pads
- **RGB LED:** for status indication and UI
- **USB-UART:** bridge based on CP2104
- **Micro USB:** connector for programming, data, power, and battery charging
- **PCB Dimensions:** 65 mm x 42 mm x 4 mm (~2.56" x 1.65" x 0.16") without battery
- **Dimensions with Case:** ~70 mm x 46 mm x 12.7 mm (~2.75" x 1.81" x 0.50")



heartyPatch Bluetooth Schematics



2/11/2017 11:24 AM 8:40:73 A:\Users\ashwin\git\protocentral_heartypatch\hardware\pc_heartypatch_v2.1\pc_heartypatch_v2.1.act





Raspberry Pi W



Technical Specifications

The Raspberry Pi Zero W extends the Pi Zero family. Launched at the end of February 2017, the Pi Zero W has all the functionality of the original Pi Zero, but comes with with added connectivity, consisting of:

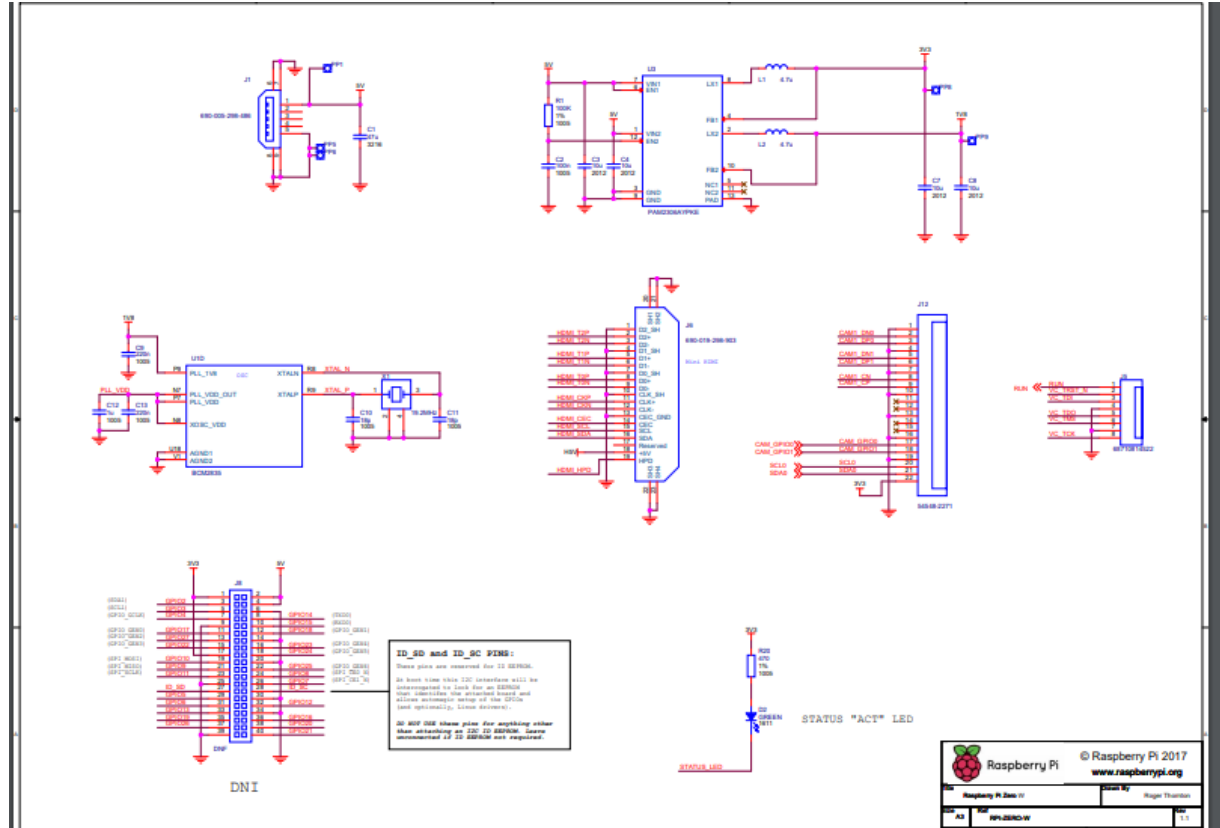
- 802.11 b/g/n wireless LAN
- Bluetooth 4.1
- Bluetooth Low Energy (BLE)

Like the Pi Zero, it also has:

- 1GHz, single-core CPU
- 512MB RAM
- Mini HDMI and USB On-The-Go ports
- Micro USB power
- HAT-compatible 40-pin header
- Composite video and reset headers
- CSI camera connector



Raspberry Pi W Schematics



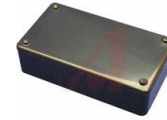


heartyPatch + Raspberry PI W as a next generation Holter



Bluetooth

Raspberry PI W +
Battery in case



Industry standard for transmitting heart rate measurements over Bluetooth:

https://www.bluetooth.com/specifications/gatt/viewer?attributeXmlFile=org.bluetooth.characteristic.heart_rate_measurement.xml

Notifi- cation Handle	Flags	Heart Rate	RR Interval LSB	RR Interval MSB	
2ax	10b	44x	82x	03x	10



Vitals Blockchain

- IBM Hyperledger Fabric + Composer
- A network where patient's vitals are continuously updated by a machine and stored on the Blockchain
- Assets: Vitals, Beds
- Participants: Patient, Doctor, Hospital, Unit, Machine
- Transactions: UpdateVitals, Admit



What is IBM Blockchain Platform?

IBM Blockchain Images

IBM Blockchain Docker images are based on Hyperledger Fabric v1.0 with a number of enhancements for serviceability. These images also benefit from a complete series of tests for functionality, stability, and performance across the following supported system platforms: z Systems and LinuxONE (s390), Power (ppc64le), and x86.

IBM Technical Support

Technical support may be purchased only when using the IBM Blockchain images available from the [IBM Blockchain Docker Hub repo](#). Support will not be provided for images that have been altered.

Special Thanks to Greg Lacey of IBM who got us the help we needed when we needed it.





Who is Vicom Infinity ?



Vicom Infinity, Inc. is a Premier IBM Premier Business Partner supplying mainframe computer equipment, computer storage equipment, and associated software products. We also provide a full-spectrum of hardware- and software-related services including, but not limited to, consultation, education, installation, implementation, and migration as well as IT consulting that specializes in assisting customers in projects that exploit their past investments in IBM Z and Storage systems products.

At Vicom Infinity, our philosophy for transforming IT functionality is simple: *combine proven technology with the infinite possibilities of innovative thinking*. The results are powerful systems, based on IBM® Z mainframe servers, that fully integrate with critical business applications. These systems serve as a solid foundation for just about any application, including the ever-increasing demands of the Digital Business.

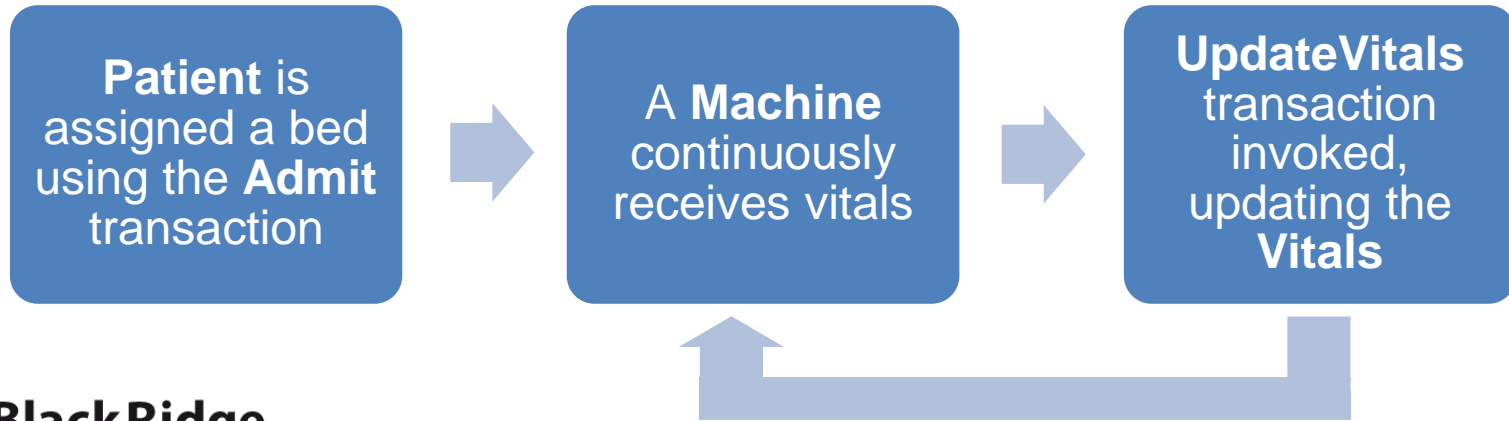
Our expertise in providing processing solutions for high-availability environments ensures we succeed at a primary objective: to develop each IT transformation seamlessly, with no impact on our clients' continued production and established workloads. Everything we do — from systems analysis to custom installations, through knowledge transfer — supports that objective.

Yongkook (Alex) Kim of Vicom Infinity helped us to get the IBM Blockchain Images running which accelerated the project. This paves the way for us to move forward to the IBM LinuxONE™ (z Systems)



Vitals Blockchain

- Bed and Machine paired
- Patient and Vitals paired
- Hospital have Units, Units have Doctors, Doctors have Patients
- Machine updates Vitals





Driving Innovation

Solution Based on Industry Standards

Numerous software vendors can provide applications quickly

Solution based on Open Source Software

Facilitates being able to add value(BlackRidge Software) with quick time to market and BlackRidge Support

Facilitates being able to quickly write new applications (IBM Hyperledger) with quick time to market and IBM support

Solution based on Open Source Hardware(New Concept)

Would be very easy to build a custom board that combines heartyPatch and Raspberry PI Zero W on one PCB



Thank you

Tony Sager, tsager@blackridge.us

CTO Commercial Markets