Embedded Software Design Techniques

DAY 1 : Software Architectures 101

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THE SPEAKER

Jacob Beningo

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Beningo Embedded Group - President

Focus: Embedded Software Consulting

An independent consultant who specializes in the design of real-time, microcontroller based embedded software.
He has published two books:
- Reusable Firmware Development
- MicroPython Projects
- Embedded Software Design (https://bit.ly/3PZCtNO)

Writes a weekly blog for DesignNews.com focused on embedded system design techniques and challenges.

Visit www.beningo.com to learn more …

Visit 'Lecturer Profile' in your console for more details.

Course Sessions

- **Software Architectures 101**
- Designing RTOS-based Applications
- Architecture Verification Techniques
- Designing Quality into Embedded Systems
- Software Configuration Management Techniques

1 Software Design Philosophy

What guides your software development?

Fight the Biggest Fires

Agile Methodologies

At its core, Agile is about[1]:

1) **Individuals and interactions** over processes and tools
2) **Working software** over comprehensive documentation
3) **Customer collaboration** over contract negotiation
4) **Responding to change** over following a plan

"Some folks think that Agile is about going fast. It's not. It's never been about going fast. Agile is about knowing, as early as possible, just how screwed we are."

-- Bob Martin

[1]Clean Agile, Bob Martin

Successful Embedded Software
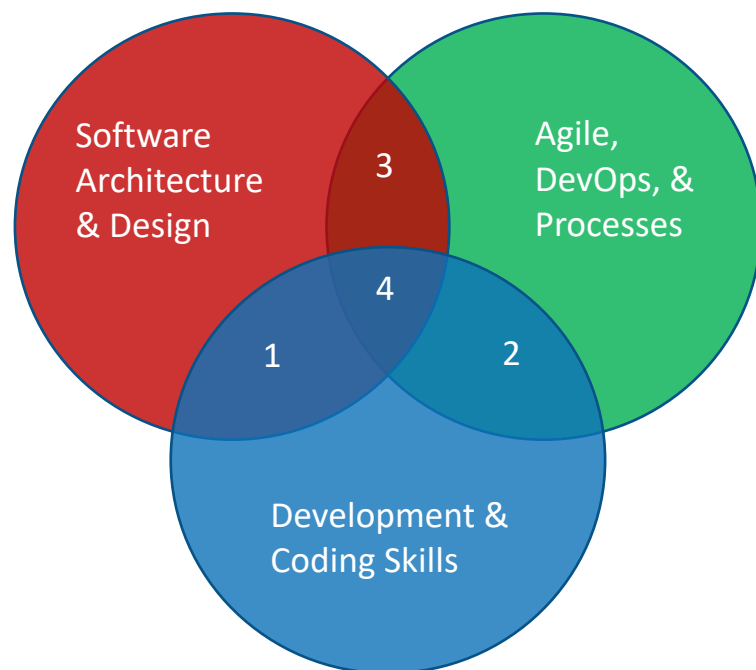
1 - Late, Inconsistent, Quality Issues
2 - Late, Rework, Lost / Meandering
3 - Never completed
4 - Successful Delivery

Where do you fit?

https://www.surveymonkey.com/r/TC5N2YL

Which area of the Venn Diagram do you think you are in?

1 - Late, Inconsistent, Quality Issues
2 - Late, Rework, Lost / Meandering
3 - Never completed
4 - Successful Delivery

2 Architecture Design Considerations

Properly decomposing an application can dramatically affect scalability, maintainability and reuse.
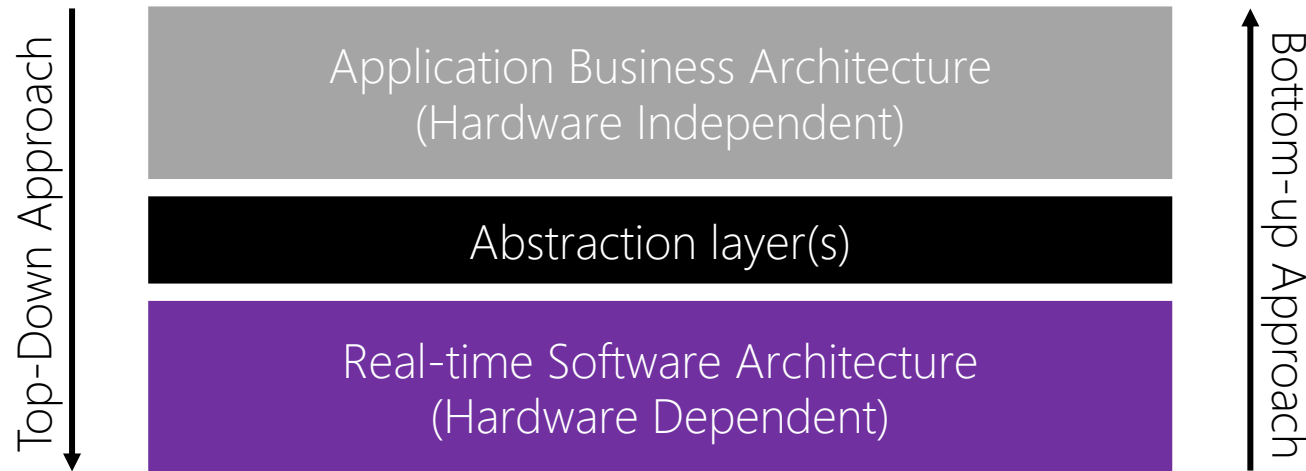
Architecture Benefits

- A plan, and road map to what is being built

- A software picture that can be used to train engineers and explain software to management and stakeholders

- Minimizing rework by minimizing code changes

- Decreased development costs

- Clear picture on what is being built

- An evolvable code base that can stand the tests of time (at least product lifetimes)
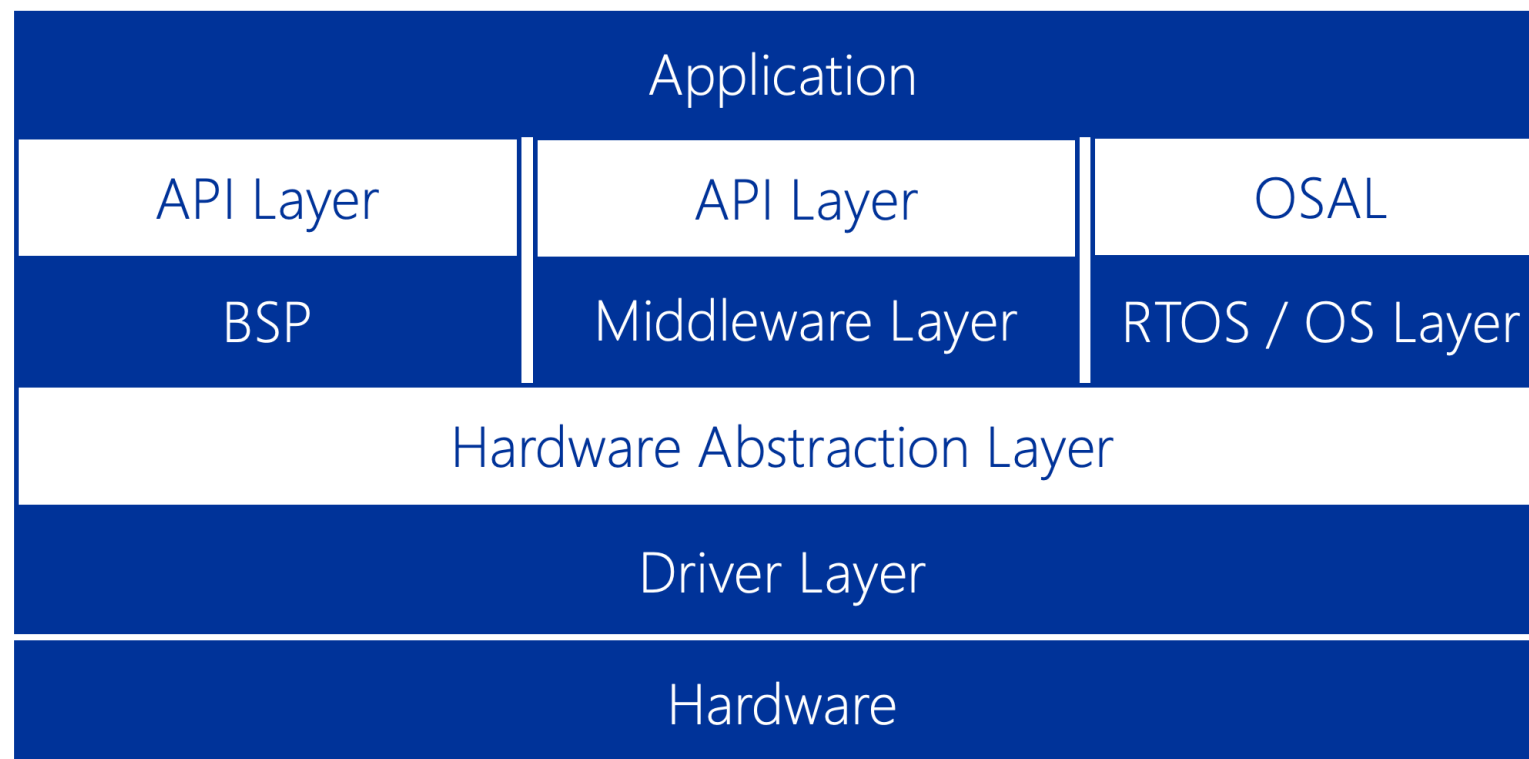
Warning:
    Just because you "do Agile", doesn't mean you don't design your architecture up front!

A Tale of Two Architectures

Top-Down Approach →

Bottom-up Approach →

| Application Business Architecture (Hardware Independent) |
| Abstraction layer(s) |
| Real-time Software Architecture (Hardware Dependent) |

Technical Layering

Application		
API Layer	API Layer	OSAL
BSP	Middleware Layer	RTOS / OS Layer
Hardware Abstraction Layer		
Driver Layer		
Hardware		

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Application Domains Partition the Application

Privilege Domain	Security Domain	Execution Domain	Cloud Domain

How do you think about embedded applications?
- In technical layers
- In domain layers
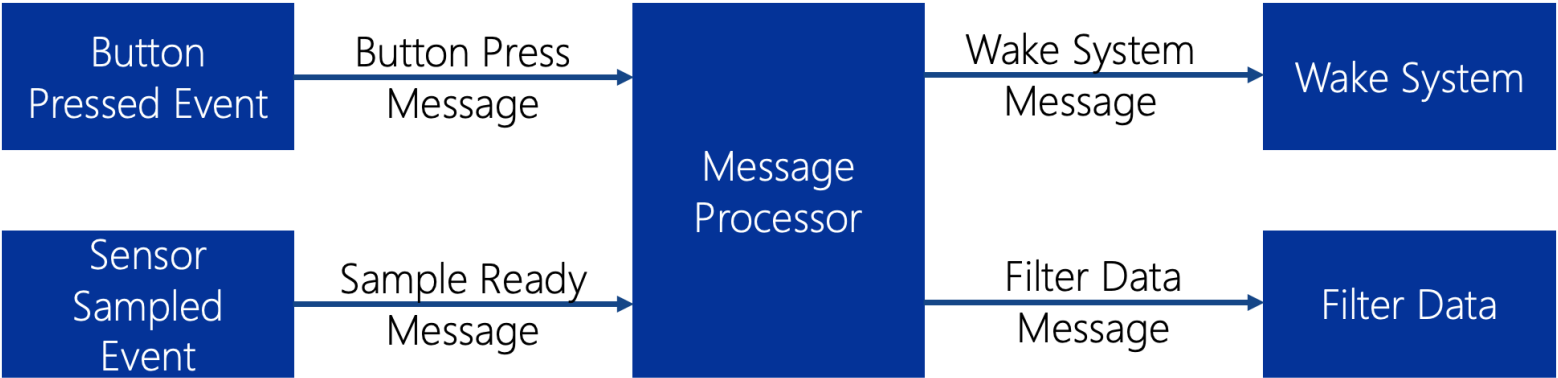- Both
- Other

**3** Software Architectures

# Event Driven Architectures

Easily scales:

Microservices

A microservice architecture builds applications as a collection of small autonomous services developed for a business domain. Microservices embody many modern software engineering concepts and processes such as Agile, DevOps, and continuous integration and continuous deployment (CI/CD).
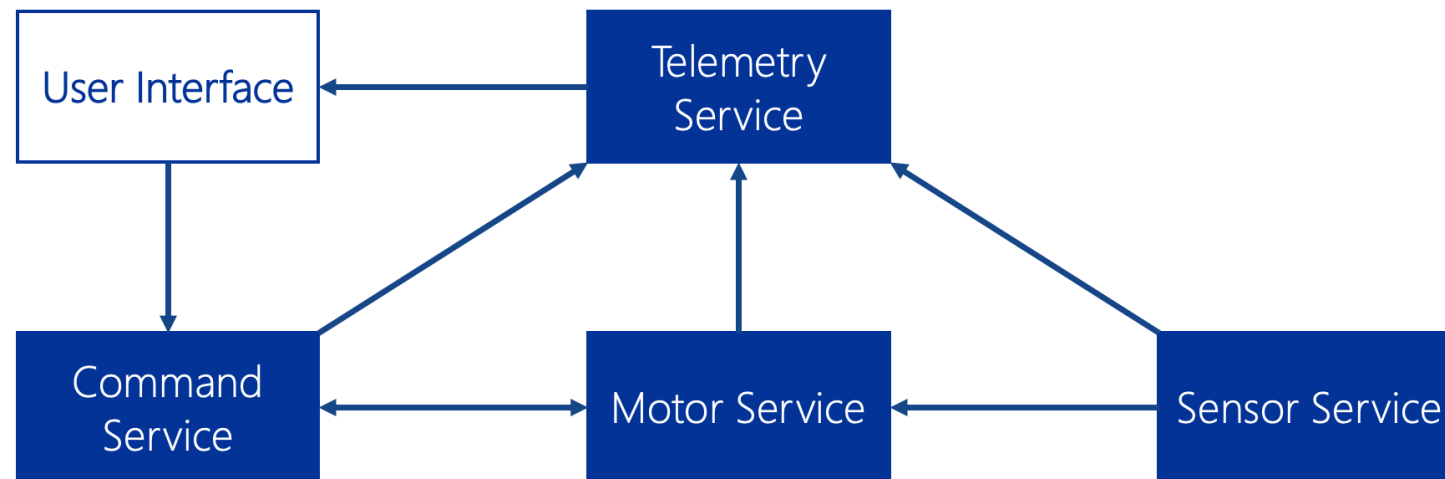
Microservices
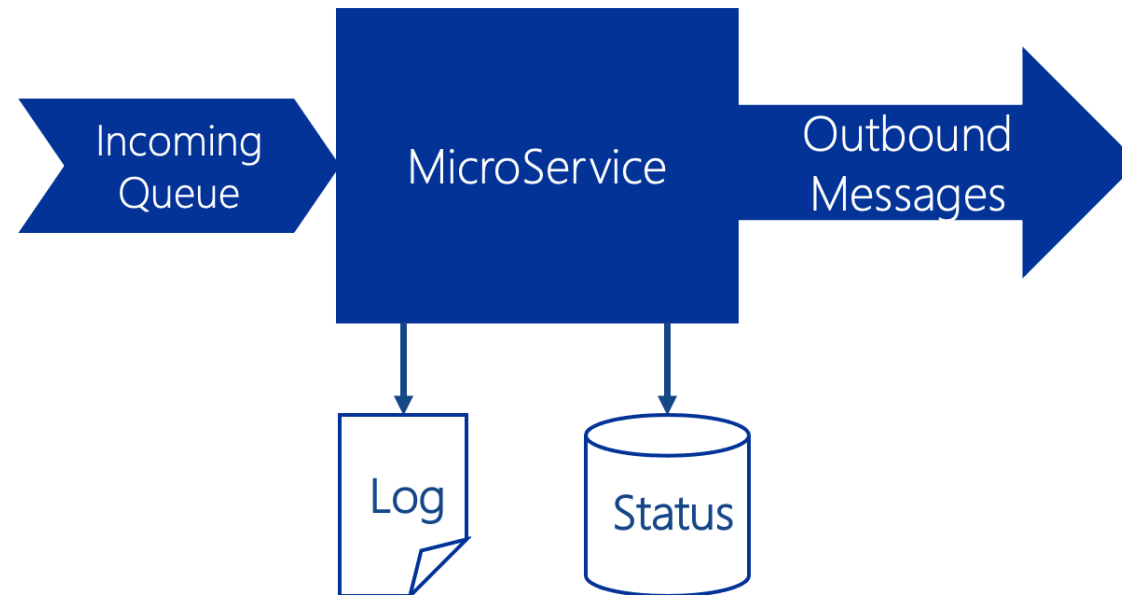
What is your experience with Microservices?

- First time hearing about them

- Know about them, but haven't used them

- Have created a basic architecture before

- Expert

- Other

4 Going Further

Thank you for attending

Please consider the resources below:

- www.beningo.com

  - Blog, White Papers, Courses

  - Embedded Bytes Newsletter

    - http://bit.ly/1BAHYXm

  - Embedded Software Design

    - https://bit.ly/3PZCtNO

From www.beningo.com under

   - Blog > CEC – Embedded Software Design Techniques

Thank You