

LBTM

I.A.S: Discover Expedition Education and Outreach Investors Call

The University of North Texas College of Engineering

3/6/24 1700 CST

Luka Bostick

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✉ LukaBostick@my.unt.edu

🌐 <https://github.com/LBTM-Luka/3.6.24>

⌚ github.com/LukaBostick

OVERVIEW
O

INTRODUCTION TO QUANTUM COMPUTING
OOOO

DISCOVER EXPEDITION
OOOO

LBTM
OO

RESULTS
OOOO

COMMITTEE REVIEW
OOOOOOOOOO

MATERIALS FOR THIS TALK



LBTM Investors Call

Committee Review and Vote

Review Committee

Name	Institution	Qualifications	Email
Jonas Wagner	UT Dallas, UW- Platteville	Mechanical Engineering PhD Student Engineering Physics and Electrical Engineering Bs	jonas.wagner.2826@gmail.com
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Dr. Jacob Hochstetler	UNT, Fidelity Investments	Computer Science and Engineering PhD VP, Cloud Engineering at Fidelity	Jacob.Hochstetler@unt.edu
Dr. Austen Moss	UNT	Organic Chemistry PhD	austen.moss@unt.edu
Willy Vasquez	UT Austin, MIT	Cryptography PhD Student Computer Science Ms	wrv@utexas.edu
Hannah Pil	NC State Univ.	Genetics PhD	hdpl@ncsu.edu

Overview

Talk Order

- Introduction to Quantum Computing
- Discover Expedition
- What is LBTM?
- I.A.A.S: Discover Expedition Education and Outreach
- Committee Review and Vote
 - UX
 - Web Architecture
 - Stack

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Introduction to Quantum Computing

LBTM

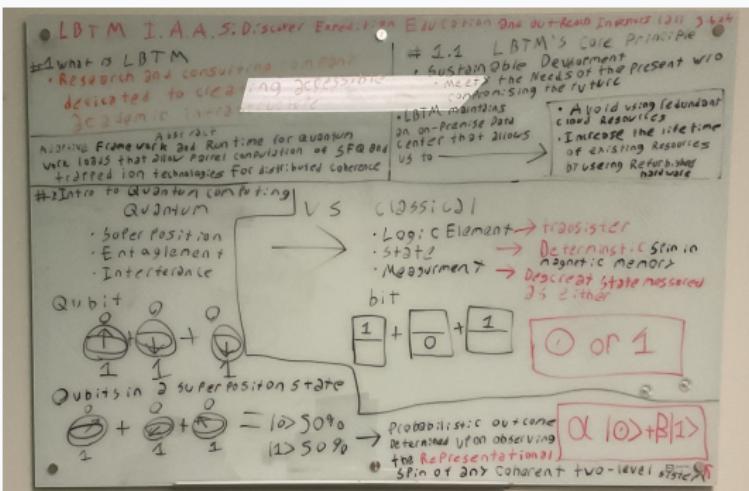
- Qubits
- Gates
- Algorithms

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Introduction to Quantum Computing

		Classical Computer
Fundamental Logic element		"Bit": classical bit (transistor, spin in magnetic memory, ...)
State		$0 \text{ or } 1$
Measurement	Discrete states Deterministic measurement: EX Set as 1, measure as 1	
		Quantum Computers
"Qubit": quantum bit	(any coherent two-level system)	
Superposition	$\alpha 0\rangle + \beta 1\rangle$	
$ 0\rangle$ "And" $ 1\rangle$	Superposition states Probabilistic measurement: EX IF $ \alpha = \beta $, 50% $ 0\rangle$, 50% $ 1\rangle$	

Introduction to Quantum Computing



Types of Qubits

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1. A Photonic qubit → a single particle of light
2. Trapped ion qubit → the outermost electron of an ion
3. Superconducting qubit → Resistance-free current at very low temperature
4. Topological qubit → Collection of quasiparticles

²quantum computing algorithms barry burd <https://www.amazon.com/Quantum-Computing-Algorithms-little-Math-ebook/dp/BoBQWDLZSZ>

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DISCoVER Expedition

LBTM

- Team
- Research
- Outreach

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LBTM Project in Active Development

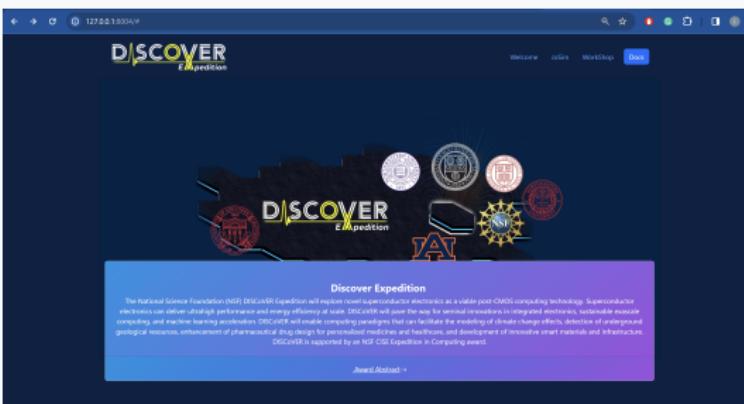
Expedition

Discover



Discover Expedition³

Grant Overview



³<https://discoverexpedition.usc.edu/>

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What is LBTM?

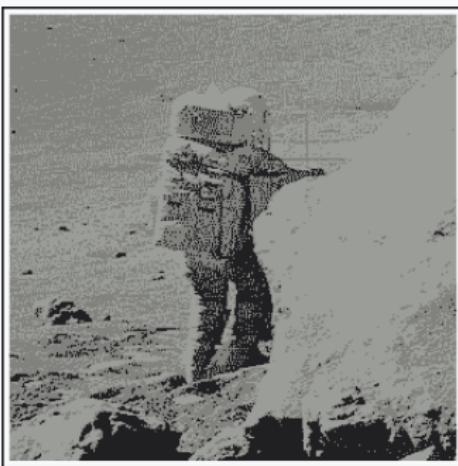
LBTM

- History
- Company Principles
- Financial Disclosure

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What is LBTM?

1. Research and Consulting Company dedicated to creating accessible academic infrastructure



L B T M
Research and Development

LBTM's Core Principle

1. Sustainable Development

- Meets the needs of the present without compromising the future⁴
- LBTM maintains an on-premise Data Center that allows
 - Avoid using redundant cloud Resources
 - Increase the lifetime of existing Resources by using refurbished hardware

⁴Massoud Pedram | Sustainable Computing A Quantitative Perspective
<https://discoverexpedition.usc.edu/outreach/#seminarseries>

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I.A.A.S: Discover Expedition Education and Outreach

LBTM

- Problem Statement
- Design: Constraints
- Architectural: Principles

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I.A.A.S For Quantum Education

1. Constraints⁵

- 1.1. GraphQL to drive the UI
- 1.2. Message Driven
- 1.3. Reactive
 - 1.3.1. Enable and encourage the UI to update in real-time

⁵Royal, Peter, author. Building Modern Business Applications Reactive Cloud Architecture for Java, Spring, and PostgreSQL. Berkeley, CA:Apress : Imprint: Apress, 2023.

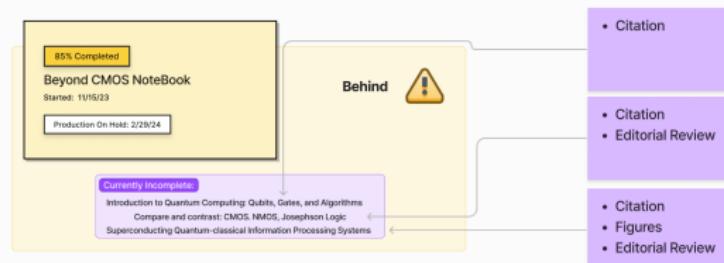
I.A.A.S For Quantum Education

1. Principles⁶

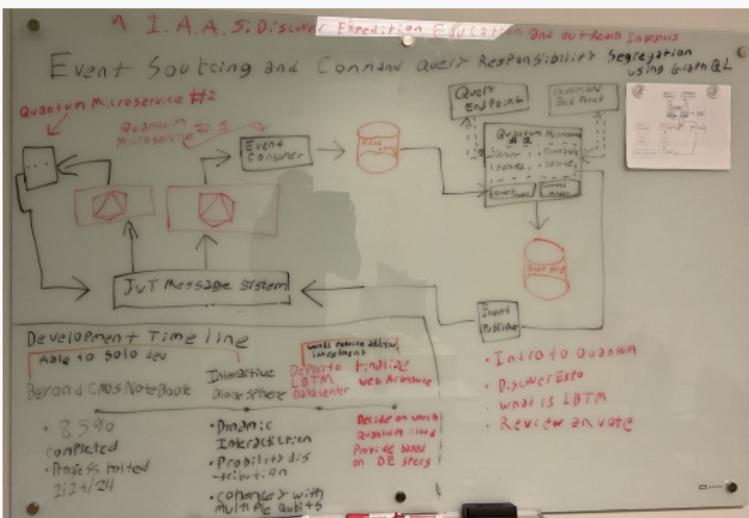
Description	Principles
VC	Never Forget
Observer → <i>State</i>	Message Driven
(OLTP)+(OLAP)	Read/Write Separation
Low Downtime	Partial Availability
nonspecific Stack	Design Flexibility
Microservices	Modularity
TDD	Testability
No architecture Rewrites	Amenability to Change

⁶Royal, Peter, author. Building Modern Business Applications Reactive Cloud Architecture for Java, Spring, and PostgreSQL Apress, 2023.

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I.A.A.S For Quantum Education



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Committee Review and Vote

LBTM

- UX
- Web Architecture
- Stack

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Voting Instructions: Please send items for approval to my email. Once I've gathered enough feedback, I'll update the committee. The options are listed in order of my recommendation and comfort level.

UX: Option 1

The screenshots show a dark-themed website for 'DISCOVER EXPEDITION'.

Screenshot 1: Home Page

Discover Expedition
The National Science Foundation (NSF) DISCOVER Expedition is a research program to create and demonstrate technologies to enable post-COVID engineering technology, innovation, education, and engagement. This website is designed to provide the public with the latest news and information about the project's activities, including research, education, and outreach. The website also features a blog where users can share their thoughts and ideas about the project's progress and impact.

Screenshot 2: Video Section

Videos

Why SQUID (superconductor electronic)?
SQUID - Next-Gen Quantum Sensors
Comparing energy efficient SQUID and SQUPE against CMOS (including integrated cooling)

Why NOW?
Energy efficiency applications
Need for energy efficiency
Ability to meet new design needs in the future
Microscopic studies and applications in computing technology

Screenshot 3: Meet The Team

MASOUD PEDRAM
Researcher at National Institute of Standards and Technology (NIST)
EBY G. FREEMAN
Researcher at National Institute of Standards and Technology (NIST)
MIRALI AVAFAKRAM
Researcher at National Institute of Standards and Technology (NIST)

UX: Option 2

L^AT_EX.css

VINCENT DÖRIG

MAY 2020

Abstract

This almost class-less CSS library turns your HTML document into a website that looks like a L^AT_EX document. Write semantic HTML, add `<link rel="stylesheet" href="https://latex.now.sh/style.css">` to the `<head>` of your project and you are good to go. The source code can be found on GitHub at <https://github.com/vincentdoerig/latex-css>.

UX: Option 3

Rhythm-Evolution

The image shows a dark-themed website template for "Rhythm Evo". At the top, there is a navigation bar with links: Home, Pages, Elements, Portfolio, Blog, Shop, a search bar, a cart icon, and a user profile icon. Below the navigation, the main content area has a dark background with light-colored diagonal lines. In the center, the text "RHYTHM TEMPLATE" is displayed above a large, bold, white text block that reads "We bring innovation ideas into design". At the bottom of this section are two white rectangular buttons with black text: "LEARN MORE" and "START PROJECT". A small circular progress bar is visible at the bottom center.

Architecture: Option 1

Event Sourcing and Command Query Responsibility Segregation

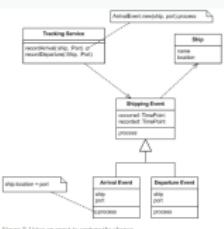
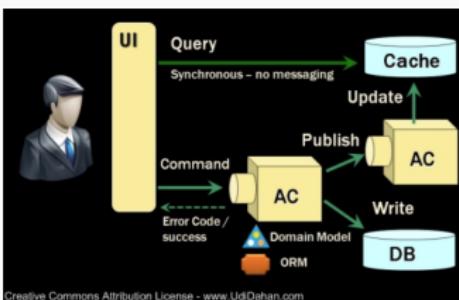


Figure 2: Using an event to capture the change.

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⁷<https://www.martinfowler.com/eaaDev/EventSourcing.html>

⁸<https://udidahan.com/2009/12/09/clarified-cqrs/>

Architecture: Option 2

Hexagonal Architecture

Reaching the hexagonal application with driving operations 135

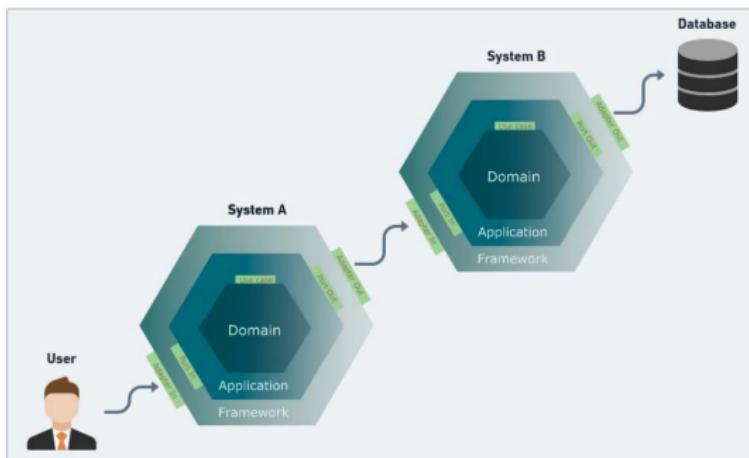


Figure 5.9 – Multiple hexagonal applications

Stack: Option 1

LAMP

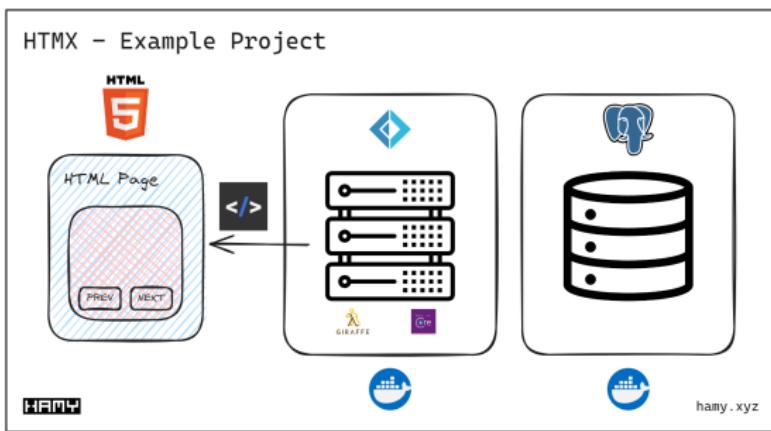


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¹⁰LAMP Stack: The Power of Open-Source in Web Development
[https://www.qsoft.com/post/
lamp-stack-the-power-of-open-source-in-web-development](https://www.qsoft.com/post/lamp-stack-the-power-of-open-source-in-web-development)

Stack: Option 2

F#, PostgreSQL, and HTMX¹¹

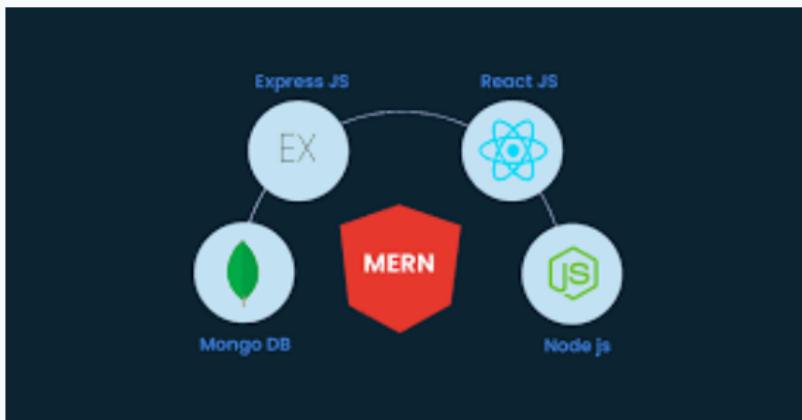


¹¹F# is a JavaScript and .NET language for webhttps://fsharp.org/

¹²<https://hamy.xyz/labs/2023-12-fsharp-htmx>

Stack: Option 3

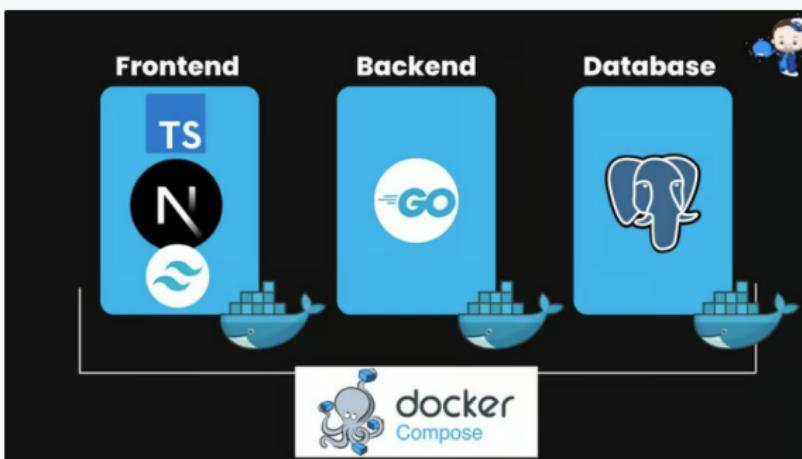
MERN



¹³<https://inzint.com/mern-stack-why-should-we-choose-mern-stack/>

Stack: Option 4

Go + TypeScript with nextjs, PostgreSQL and Docker



¹⁴<https://dev.to/francescoxx/go-typescript-full-stack-web-app-with-nextjs-postgresql-and-docker-42ln>

I want to thank Land Sea, and Sky and my academic review committee. ,

Without your support, the Work we do at LBTM would be nonexistent



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