INSTRUCTOR LED WEBINAR - SYLLABUS

CERTIFIED BLOCKCHAIN ARCHITECTURE

Duration: 40 Hours

Delivery: BLENDED - OnDemand and LIVE Instructor-Led Online - 30 Hours

Instructor(s): Jim Sullivan

Office Hours: 10:00 AM to 6:00 PM Eastern Standard Time

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Prerequisites: A strong understanding of computing and a strong understanding of blockchain

Continuing Education Units: 2.4

Certifiecation Exam: Blockchain Architecture
Certification Body: Blockchain Certification Association

Course Overview:
The Blockchain Architecture course is designed for both the technical, existing architects and software developers, and for less-technical business managers to comprehend the practical development and implementation of an enterprise blockchain application. Professionals seeking to align their efforts with the technology are made aware of the various aspects related to blockchain technology development. Understanding the available platforms, hosting, associated technologies, languages and security is paramount to the success of any enterprise deployment. The course will lay out the pros and cons of each decision as well as a non-technical summary of implementation.

Course Composition:

OnDmeand :	Key Management	Modules 1 - 4
OnDmeand :	Blockchain Architecture	Modules 1 - 15
Instructor Led Online:	Blockchain Architecture Workshop	Zoom
OnDmeand :	Blockchain Security	Modules 1 - 8
Instructor Led Online:	Instructor AMA	Zoom

Learning Objectives:

- Identifying the decisions and participants in a successful blockchain implementation
- Learn about various blockchain platforms – Open Source and Commercial
- Understand the hosting and mining options
- Awareness of associated technologies
- Understand the primary programming languages

- Determining the decisions surrounding the security of blockchains
- Learn about blockchain architecture for building a private or hybrid blockchain

Demonstration of Learning Outcomes:
At the conclusion of the Blockchain Architecture course students will be able to understand all the technical components of a successful blockchain solution and how to work with a team of blockchain developers and organization stakeholders to design and deploy a solution.

Evaluation:
Evaluation is based on participation and a final exam.
Weighted:
50% participation
50% on the final grade
80% overall grade is required in order to receive a Certificate of Completion.

Grading Policy:
Pass or Fail. No Credit (NC).

Attendance Requirements:
Students are expected to attend at least 70% of Instructor Led Webinar Presentations. Should a student miss any portion of the live instruction instructor led webinars are recorded and attached to the learning management. A Certificate of Completion will not be issued if attendance requirements are not met.

Student conduct and etiquette:
Students will be expected to be courteous in their conduct and communications to the instructor and classmates at all times whether such conduct or communication is in person, by telephone or electronic communications.

Behavior that persistently or grossly interferes with instructor or other student activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. The instructor may require a student responsible for disruptive behavior to leave the learning environment pending discussion and resolution of the problem and may report a disruptive student to the Student Affairs Office

Note: Disruptions, or any other distraction in the learning environment may result in a failing grade.

Course Evaluations
Course evaluations and program surveys are important components of the educational process. Students are encouraged to complete the student course evaluation form issued at the conclusion of the course. The evaluation is anonymous.

Computer/Information Literacy Expectations for Students enrolled in this class
Students in this class are expected to:
1. Use a word processing program for writing assignments (e.g., Microsoft Word)
2. Be able to access assigned websites through the internet

3. Have access to PC or mobile device for participation in course content

Course Module Overview:

BLOCKCHAIN ARCHITECTURE

Module 1: Blockchain Decision Overview

The decision to use blockchain technology is multifaceted. There are discussions of Platforms, Hosting and Mining. What sort of architectural and resource capabilities and constraints should be considered in making the early decisions that will have dramatic impact on the success of the project.

- Is blockchain technology the right solution
- Who are the participants in a blockchain project?
- What type of blockchain should be used
- What is the environment that will host the blockchain?
- What additional technologies are important to success
- What programming languages are available to various solutions
- What security considerations are there

Module 2: Blockchain Platforms

There are many existing blockchain platforms. Understanding each as well as the various pros and cons allows for selecting the most advantageous platform for each implementation of a new project. This module will cover the major platforms.

Public Platforms

- Bitcoin
- Ethereum
- Multichain
- Open chain
- Quorum
- Chain
- BigChainDB

Commercial Platforms

- Hyperledger (Fabric/Iroha)
- Hydra Chain
- Chain Core
- IOTA
- Corda
- Gospel
- Tezos

- BlockOne / EOS.IO
- Symbiont / Assembly
- Tezos

Module 3: Hosting Decisions

Each blockchain platform has specific advantages and weaknesses. Understanding how each is designed allows for a strategic implementation for each project.

- Private / Public
- Permissioned / Permissionless
- Cloud
    - IBM Blue Mix
    - AWS
    - Oracle
    - Microsoft
    - Gospel
- Distributed Networks
    - Bitcoin
    - Ethereum
    - IOTA
- Developing your own network of nodes
    - What is required
- Transaction Costs
- Interoperability

Module 4: Associated Technologies

There are a number of associated technologies and blockchain architecture that provide enhanced features and functions. This segment is a discussion of a few of them and how they impact the platform decisions.

- On-chain vs. Off-chain
- Lightning Network
- CoCo Framework
- Smart Contracts

Module 5: Development Languages

Development of blockchains is never done in a vacuum. Understanding the strengths of each development language and where it is deployed allows for alignment of existing skill sets with the internal or preferred development languages for blockchain implementations.

- C++, C : Bitcoin, Ethereum, Bitcoin Cash, Ripple, Litecoin
- JavaScript: Ethereum, Bitcoin Cash, Ripple, IOTA, Litecoin, NEM, Dash
- Java: Bitcoin Cash, IOTA, Litecoin, NEM, EOS
- Python: Bitcoin, Ethereum, Ripple, Litecoin, EOS
- Go: Hyperledger, Ethereum, IOTA,
- Solidity: Eithereum (DL)
- Kotlin: Corda (DL)
- Any server-side programming language for BUILD blockchain from Scratch (DL)

Module 6: Security and Implementation Goals

Implementation of any enterprise project is always challenging, and pitfalls seem to be everywhere. Here are a few Security and Implementation issues that should be considered with any large-scale development.

- Government Regulations
- Legal Issues
- Security Loopholes
- Defining project goals
- Metrics to determine success/failure
- Hurdles to Blockchain Adoption
- 10 secrets about blockchain

Module 7: Risk Management

A discussion on the various Risk Management aspects of technology selection.

- Enterprise Risk
- Operational Risk
- Geopolitical Risk
- Market Risk
- Reputational Risk
- Systematic Risk
- Compliance
- Third Party Risk Management

Module 8: Blockchain Architecture Overview

- We need to think along the following lines: First, the problem we're solving, secondly, the people / entities / stakeholders that we're solving the problem for, thirdly, what devices would

they use for the envisioned blockchain, fourth, what blockchain architectural options do we have.

- Thus, our thoughts of blockchain architecture would form the following thread: problem, stakeholders, blockchain type and platform, nodes, blocks, transactions and security.
- In addition, be aware of blockchain "protocols". Data storage such as Factom, cryptocurrency such as Bitcoin, Smart Contracts such as Ethereum.

Module 9: Business and Technical Components of Blockchain Architecture

When we talk about architecture we need to keep two things in mind, that is, business architecture as well as technical architecture. Many times, when we refer to architecture, we simply mean technical architecture. However, the success of a project depends on both of them.

Section 9.1 Business Components or Considerations of a Blockchain

- What **Problem** are we solving (problem definition) and for whom (i.e. enterprise project vs. entrepreneurial project)
- Who are key **Stakeholders** (**Participants**) and scale
- **Devices** for the blockchain usage
- What **Type of Blockchain** to build

Section 9.2 Technical Components of a Blockchain

- Ledger
- Smart Contracts
- Peer Network (Nodes)
- Membership
- Events
- System Management
- System Integration

Module 10: Blockchain Architectural Options

From arc hitectual point of view, we need to answer the following question: would the identified business problem that leverages the blockchain technology require multiple data sources or a single blockchain data? before we start to design a blockchain architecture.

1. Singular Architecture
2. Hybrid Architecture

Module 11: The Two Vital and Inseparable Parts of Blockchain

The two vital parts of a blockchain is to construct a valid blockchain and use it to fulfill business or other types of needs.

(A) Construction of a blockchain

- "Standard" Model of Block

High volume transaction blockchains and many other blockchains such as Bitcoin use this model. This model pack several or many transactions into one block with the structure of [Header] and [Body].

- Simple Model of Block

For a simple model, one block contains one transaction. It is much easier to build and it could be more efficient.

- Discussion: is there any other block structure differ from the above two models?
- Transaction
    - Consensus
    - Provenance
    - Immutability
    - Finality

(B) Use of a blockchain / Fulfill Business or Other Types of Needs

- Smart Contracts
- Chaincode
- Their Equivalent for Corda and Multichain
- Components for Built-from-Scratch

Module 12: High-level Description of a PoC Private (permissioned) Blockchain

Including the following:

- Analyze key **Requirements**
- Translate key Requirements into functional **Milestones**
- Translate Stakeholders / Participants into **Nodes** of a blockchain network
- Define each node's **Role**
- Decision on what **blockchain platform** to use or to **build it from scratch**
- Blockchain **Development Resources** including programming language and programmers
- Blockchain **Development**
- Blockchain **Deployment / Hosting**
- Blockchain **Support**

Module 13: Identity, Privacy and Security

As any other software platform, identity management, data privacy and protection and information security are of paramount importance.

- Identity Management
- Privacy Protection
- Security

Module 14: Blockchain Structure and Distributed Peer-to-Peer Network

Like the construction of buildings, for blockchain we need to have structures. For it to function as a network it needs to have nodes. Simply put, blocks make the structure, transactions are the "meat and potato" of blocks, the linked blocks make a chain (a ledger), of which each node has an identical copy, thus, ensuring data integrity and immutability.

- Transaction
- Block
- Data Privileges

Read, Write: full read or partial read? Full write or partial write?

- Node Creation and Management

Master Node

- Node and Data Processing

Module 15: Cryptography and Blockchain Algorithms

A key differentiator of blockchain from traditional databases is that data stored on a blockchain is tamper-resistant, that is, it's extremely difficult to hack into a blockchain to tamper its data. And the reason is that blockchain technology uses cryptography to ensure data and relationship.

- Symmetric encryption/decryption
- Asymmetric encryption/decryption

(i.e. public key and private key pair)

- ECDSA (The Elliptic Curve Digital Signature Algorithm)
- Hash
- Merkle tree
- Their Application for Block Construction

Final Exam