unext

Emerging Technologies

AI/ML

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AI/ML

Level 1

- Python Programming
- Importing & Cleaning
- Data Manipulation
- Intro to Machine Learning

Level 2

- Exploring a Database
- Summarizing and aggregating numeric data
- Exploring categorical data, unstructured text, Correlated Queries and Nested Queries.
- Window Functions and Working with dates & timestamps.
- Simple Linear Regression Modeling.
- Multiple Regression
- Ridge Regression.
- Feature Selection & Lasso.
- Nearest Neighbors & Kernel Regression

Level 3

- Solving Machine Learning requirement using Regression Model
- Deep Learning
- Image Analysis
- Natural Language Generation
- Chatbot
- Recommendation Systems
- Reinforcement Learning

Blockchain

Blockchain

Understanding Blockchain

- Blockchain Concepts
- Blockchain Features
- Public VS private Blockchain
- Security of Blockchain
    a) Distributed Databases Vs Blockchain Distributed Ledger
    b) Smart Contractors
    c) Fundamentals of Decentralization
- Blockchain Use Cases
    a) Blockchain Decentralized Identities -Zero Knowledge Proofs Overview
    b) Enterprise Blockchain Use cases
        I. Track & Trace with IOT & blockchain
        II. Supply Chain (On chain explanation)

Introduction to Consensus

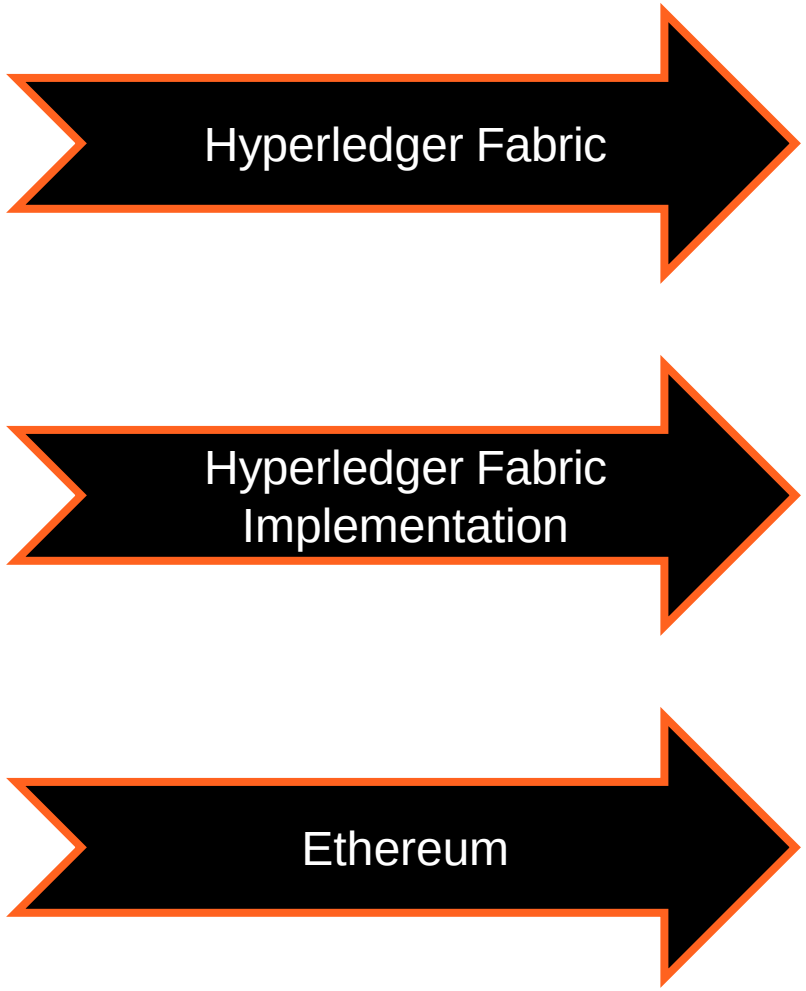
Consensus

- Byzantine Fault Tolerance (BFT),
- Crash Fault Tolerance (CFT)
- How Conesus works
- Different Consensus Algorithms – POW, POS, dPOS, Raft
- Forking & Challenges
- Hyperledger Fabric consensus

Blockchain in Fintech

- Introduction to Tokenization
- Understanding various use cases of Fintech & Tokenization
- Fungible & Non-Fungible Tokens Overview
- Stable Coins Overview
- Central Bank Digital Currencies [CBDC] Overview

Blockchain



- Hyperledger Fabric Foundations
- Hyperledger Fabric Architecture
- Enterprise Ethereum VS Hyperledger Fabric (HLF) Hyperledger Fabric Architecture foundations Chain Code aka Smart contracts
- Transaction Flow
- Genesis Block Configuration

Hyperledger Fabric Administration Basics

- Environment Setup : How to setup HLF in VM / Local system
- Projects & Use case Pre-read Discussions & questions
- Performance Measurements & scaling (Caliper)
- Understanding Chain code as a service
- Development of a Use case (Writing chain codes & Deployment)

- Ethereum Introduction
- Ethereum VS Hyperledger Fabric
- Ethereum Features
- Smart Contracts
- Ethereum Installation
- Ethereum Accounts
- Smart Contracts
- Ethereum Virtual Machine

Blockchain

Ethereum

- Deploying Smart Contracts
- Smart Contracts and DAOs
- Decentralize Apps

Ethereum Smart Contracts

- Smart Contracts
- Key Properties of smart Contracts
- Language for Smart Contracts
- Advantages of Smart Contracts
- Disadvantages
- Smart Contracts Use cases
- Web App dev
- Installing Geth
- Web3.js
- Truffle

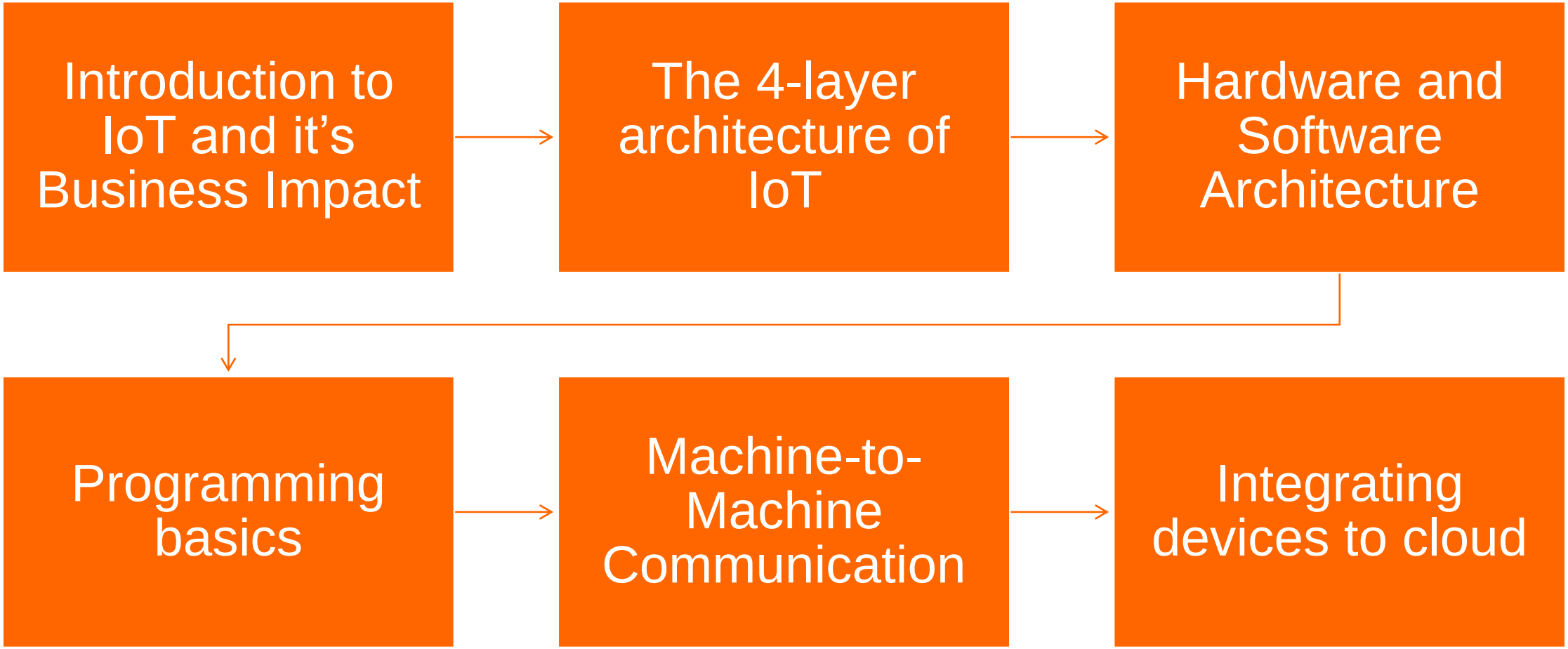
Use cases & Demos

- Block chain based smart contract for Supply chain
- Block chain-based solution for Business Network to illustrate using Access Control over Personally Identifiable Information.
- Block chain-based solution for Commodities Trading Business Network.
- Block chain-based solution for Blockchain Certificates for Education
- Block chain based smart contract for e-voting solution.
- Block chain based smart contract for fund collection and fund distribution.

Program Modules

IoT

Module Flow


Introduction to IoT and it's Business Impact
The 4-layer architecture of IoT
Hardware and Software Architecture
Programming basics
Machine-to-Machine Communication
Integrating devices to cloud

Day 1

Introduction to IoT and it’s Business Impact (1 hours)

TOPICS

- Introduction to IoT
- Quick history of the Internet - PC, Internet, Mobile Internet, IoT
- Case Studies of IoT Applications
  - Remote connected operations
  - Asset Management
  - Production Optimization
  - Predictive Maintenance
- Blueprint for starting an IoT Project
- People Impact: Building an IoT team, skills needed, Upcoming IoT Job roles

LEARNING OUTCOMES

- Understand the Business benefits of IoT
- Understand the key application types of IoT
- Understand the application of IoT to various domains

The 4-layer architecture of IoT (2 hours)

TOPICS

Layer 1: Sensors and devices

- Types of sensors and actuators, categories of devices, device management

Layer 2: IoT Gateways and Networking

- Gateway device characteristics, Communication protocols, networking protocols, data protocols, Edge Analytics

Layer 3: Cloud computing

- IaaS, PaaS, SaaS models, ingestion, storage, retrieval, cloud computing platforms, Role of Cloud in IoT

Layer 4: Analytics and Machine Learning

- IOT Data Science life-cycle, introduction to different types of Analytics, introduction to ML

Live demo showcasing and IoT use case involving all 4 layers of IoT

LEARNING OUTCOMES

- Get exposed to all the 4 layers of IoT
- Appreciate the data flow path of a typical IoT system – from edge to cloud

Hardware and Software Architecture(5 hours)

TOPICS

Hardware as relevant to Embedded Systems

- The Microprocessor/Microcontroller
- Signal conditioning, ADC/DAC
- Hardware Constrained Systems

Introduction to Raspberry Pi

- GPIO layout and board specifications
- Booting up and OS options overview
- Linux overview (Kernels) and Bash command line
- Remote access setup

Introduction to Arduino

- Board specifications
- Arduino programming language
- Simulation Environment (IDE)

Introduction to ARM architecture

Software as relevant to Embedded Systems

- Programming in resource constrained environments
- Realtime performance expectations and how to realise them
- Memory types, segments & Management
- Software development tools & IDE

Introduction to SoC

- SoC Applications
- SoC vs SoPC (Reconfigurable Hardware)
- On-Chip Interconnections
- Bus-based and NoC based SoC Interconnects

LEARNING OUTCOMES

- Understand fundamentals of Hardware and Software
- Understand how embedded systems interface with the environment in which it sits – Sensors and Actuators
- A basic understanding of the principles of Systems on Chip
- Understand ARM architecture

Day 2 (Hands-on)

Programming basics (5 hours)

TOPICS

Introduction to Python

- Why Python
- Python Basics
  - Variables and Operators
  - Data Structures
  - Control flow
  - Functions
- Programming Raspberry Pi with Python
  - Interfacing I/O devices
  - Talking to the cloud

LEARNING OUTCOMES

- Understand why python is the most feasible and compatible language for developing IoT solutions
- Learn the basics of python programming on raspberry pi

Machine-to-Machine Communication (3 hours)

TOPICS

- Raspberry Pi as Gateway
  - Data Aggregation
  - Protocol Conversion
  - Local control
  - Software Updates
- IoT Stack: Mosquito, Node-red, InfluxDB, Grafana
- Sensor's integration and nodes handling
- Demo : Node Red for M2M

LEARNING OUTCOMES

- Be able to program Layer 2 of IoT devices and interface with nodes

Day 3 (Hands-on)

Integrating devices to cloud (8 hours)

TOPICS

- Device management (Connectivity, On-boarding, Authentication, FOTA, Shadow),
- Data Aggregation
- Rules engine
- Platform for Analytics
- Storing Sensor Data over Cloud Computing

Demo: Watson IoT

LEARNING OUTCOMES

- Understand the Role of cloud computing in IoT
- Understand the cloud computing deployment models
- Understand the different Cloud application architecture styles and patterns
- Learn IoT built-in PaaS services to capture device data from field to store on cloud

Required Hardware Components

Component	No.of Units/Participant
Arduino Uno	1
Raspberry Pi	1
Bread Board (Medium)	2
DHT 11 or 22	1
PIR sensor	1
Ultrasonic sensor	1
Jumper wires (M-F,F-F,M-M)	1/type
HDMI cable	1
Pushbuttons	1
LEDs mix (RGB)	10
Resistors box	1

Metaverse (AR / VR)

Awareness Module – 16 hours

Basic module

TOPICS

- Introduction
- History of Web 2.0 and evolution to Web 3.0
- What is Metaverse
- The 7 layers of Metaverse
  - Experience
  - Discovery
  - Creator Economy
  - Spatial Computing
  - Decentralization
  - Human Interface
  - Infrastructure

LEARNING OUTCOMES

- Understand the core concepts and layers of metaverse
- Be able view the metaverse as a whole and understand the related technologies, primarily focusing on what and why
- Learn about industry applications along with best practices for interacting with metaverse

Basic module

TOPICS

- Building blocks of the metaverse
  - Communication networks
  - Artificial Intelligence
  - NLP
  - Blockchain
  - AR&VR (MR)
  - Digital assets
  - Tokenomics
- Future of Metaverse
- Applications and use cases

LEARNING OUTCOMES

- Understand the core concepts and layers of metaverse
- Be able view the metaverse as a whole and understand the related technologies, primarily focusing on what and why
- Learn about industry applications along with best practices for interacting with metaverse

Intermediate Module

Duration for participants who completes basic module – 28 hours
Others – 32 hours (Basic module on overview of Metaverse for 4 hours)

Intermediate module (4 hours)

TOPICS

- Introduction
- History of Web 2.0 and evolution to Web 3.0
- What is Metaverse
- The 7 layers of Metaverse
- Building blocks of metaverse

LEARNING OUTCOMES

- Understand the core concepts and layers of metaverse
- Be able view the metaverse as a whole and understand the related technologies, primarily focusing on what and why

Intermediate module

TOPICS

- **Enabling technologies of Meta - Infrastructure**
  - Network and hardware requirements
    - Evolution of network – Wifi, progress from 5G to 6G
    - Need for real-time bandwidth application
    - Analysing high bandwidth, low latency network capabilities
    - Role of hardware in enabling high performance and miniaturization in devices

LEARNING OUTCOMES

- Be able to get insights and exposure to meta infrastructure
- Understand in detail about the enabling technologies of meta ecosystem
- Learn about programming and platform requirements of meta
- Understand and learn about the features of real-time meta implementation examples, on blockchain

Intermediate module

TOPICS

- **Enabling technologies of Meta - Infrastructure**
- Virtualization
  - Overview on computational requirements of the meta
  - Memory and data virtualization
  - Compute virtualization and
  - App virtualisation
- Overview of Local, Edge, and Fog computing
- Blockchain
  - Overview of blockchain and need for decentralization in Metaverse
  - Understanding smart contracts, NFTs and cryptocurrency
    - Creating meta mask wallets for transaction
    - Imports for Smart contracts
    - Create a smart contract with Polygon
    - Executing smart contracts from wallets
  - Realtime Solutioning using blockchain examples
    - Decentraland and Sandbox

LEARNING OUTCOMES

- Be able to get insights and exposure to meta infrastructure
- Understand in detail about the enabling technologies of meta ecosystem
- Learn about programming and platform requirements of meta
- Understand and learn about the features of real-time meta implementation examples, on blockchain

Intermediate module

TOPICS

- **Implementation Technologies**
  - Programming and Platform requirements of Meta
    - ARVR: AI driven 3D engines
      - Essential aspects of extended reality (XR) in building metaverse
    - Asset creation:
      - Overview on asset creation from synthetic media to NFTs
    - Network Implementation
- **Applications – Current and Future of Meta**
  - Interface and access: Consumer and Enterprise-focused hardware and displays (VR/AR haptic tech/devices)
  - User experience: Overview on asset marketplaces
  - Examples: Opensea, Algorand & Metamask

LEARNING OUTCOMES

- Be able to get insights and exposure to meta infrastructure
- Understand in detail about the enabling technologies of meta ecosystem
- Learn about programming and platform requirements of meta
- Understand and learn about the features of real-time meta implementation examples, on blockchain

Advanced Module

Duration for participants who completes Intermediate module – 26 hours
Others – 48 hours

Advanced module

TOPICS

- Introduction
- History of Web 2.0 and evolution to Web 3.0
- What is Metaverse
- The 7 layers of Metaverse
- Building blocks of metaverse

LEARNING OUTCOMES

- Understand the core concepts and layers of metaverse
- Be able view the metaverse as a whole and understand the related technologies, primarily focusing on what and why

Advanced module

TOPICS

- **Enabling technologies of Meta - Infrastructure**
  - Network and hardware requirements
    - Evolution of network – Wifi, progress from 5G to 6G
    - Need for real-time bandwidth application
    - Analysing high bandwidth, low latency network capabilities
    - Role of hardware in enabling high performance and miniaturization in devices

LEARNING OUTCOMES

- Understand metaverse and interoperability of technologies across the components of meta pyramid
- Be able to get insights and exposure to meta infrastructure
- Understand in detail about the enabling, and implementation technologies of meta ecosystem
- Learn about programming and platform requirements of meta
- Understand and learn about the features of real-time meta implementation examples, on blockchain
- Be able to build virtual environment using Unity
- Understand and learn identifying the scope and objectives for implementing metaverse projects

Advanced module

TOPICS

- **Enabling technologies of Meta - Infrastructure**
  - Virtualization
    - Overview on computational requirements of the meta
    - Memory and data virtualization
    - Compute virtualization and
    - App virtualisation
  - Overview of Local, Edge, and Fog computing
  - Blockchain
    - Overview of blockchain and need for decentralization in Metaverse
    - Understanding smart contracts, NFTs and cryptocurrency
      - Creating meta mask wallets for transaction
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- Be able to build virtual environment using Unity
- Understand and learn identifying the scope and objectives for implementing metaverse projects

Advanced module

TOPICS

- **Implementation Technologies**
  - ARVR: AI driven 3D engines
    - Essential aspects of extended reality (XR) in building metaverse
    - Create a metaverse using Unity - Virtual Space creation
    - Creation of a 3D Scene
    - Generating objects
    - Generating object movements
    - Generating object interactions
    - Creating Virtual assets – land, avtar customisation
    - Capstone Project (Gaming environment)

LEARNING OUTCOMES

- Understand metaverse and interoperability of technologies across the components of meta pyramid
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Advanced module

TOPICS

- **Implementation Technologies**
  - Asset creation:
    - Overview on asset creation from synthetic media to NFTs
    - Network Implementation
    - Exercise: Implementation of virtual machine and blockchain infrastructure on cloud
- **Applications – Current and Future of Meta**
  - Interface and access: Consumer and Enterprise-focused hardware and displays (VR/AR haptic tech/devices)
  - User experience: Overview on asset marketplaces
  - Examples: Opensea, Algorand & Metamask

LEARNING OUTCOMES

- Understand metaverse and interoperability of technologies across the components of meta pyramid
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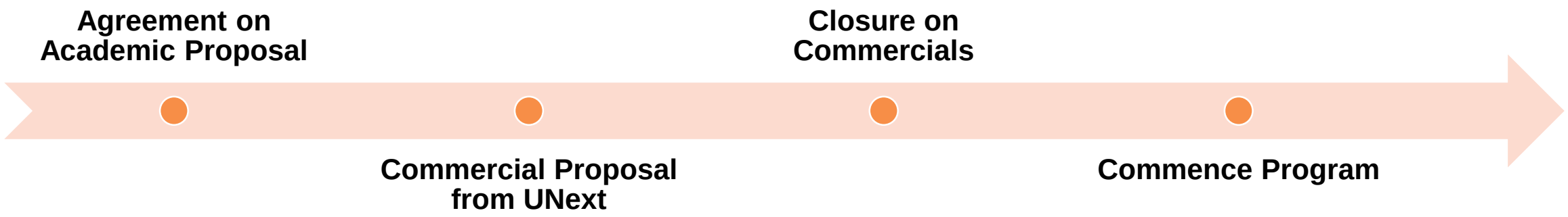
- Understand and learn about the features of real-time meta implementation examples, on blockchain
- Be able to build virtual environment using Unity
- Understand and learn identifying the scope and objectives for implementing metaverse projects

Next Steps…

1. Agreement on Academic Proposal between client and UNext
2. Commercial proposal from UNext
3. Closure on Commercials from client
4. Commence Program




Thank You