ackee blockchain

Summer School of Solana

LECTURE 7

Solana NFTs

Ondrej Rehacek

ackee blockchain

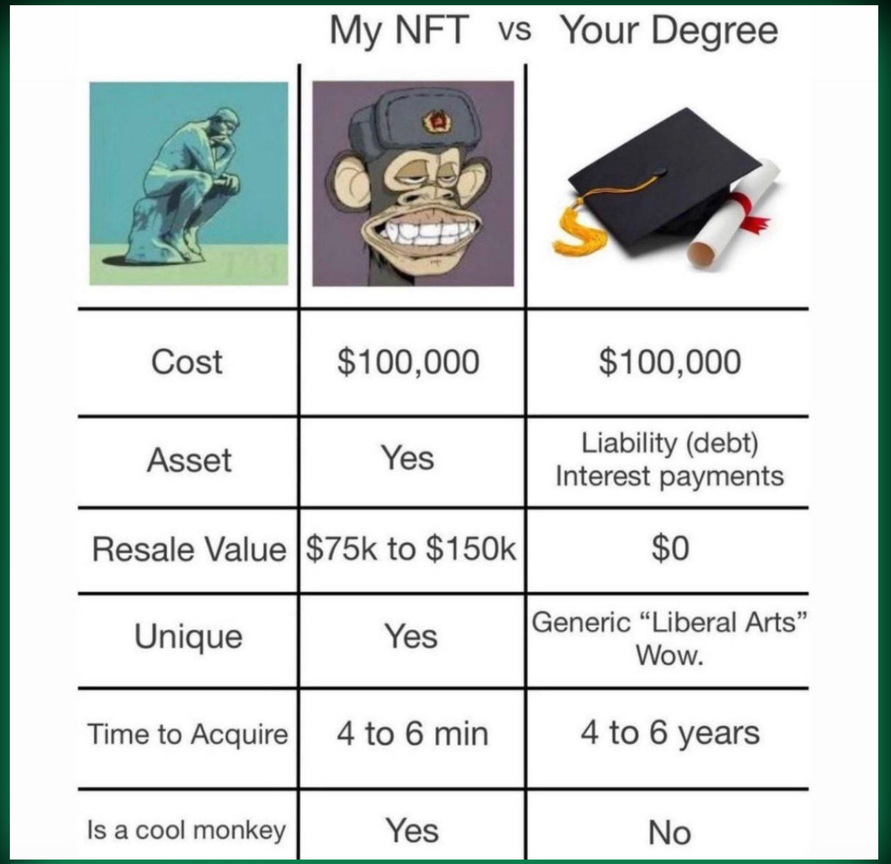
About me

Ondrej Rehacek

- Solana advisor @ Ackee Blockchain
- Game developer & surfer in progress 🏄
- Discord: OR#1673
- Twitter: @kyoudaighost

About this lecture

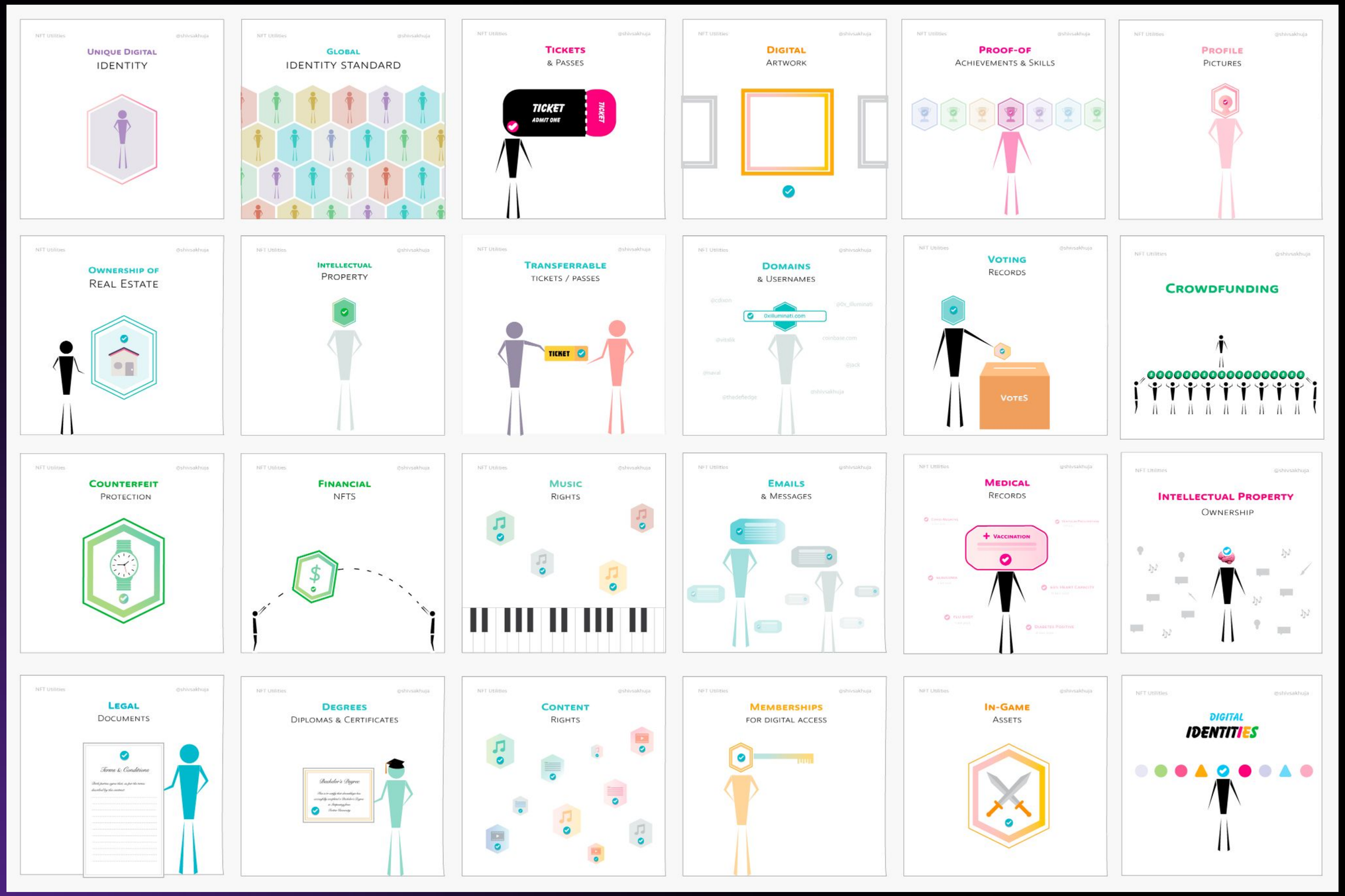
- **What are NFTs?**
  - General introduction
  - Use-cases
- **NFT on Solana network**
  - Token Structure
  - Metadata and storage
- **Introduction to Metaplex tools**
- **Hands-on exercise**
  - Create and mint your NFT



What are the NFTs ?

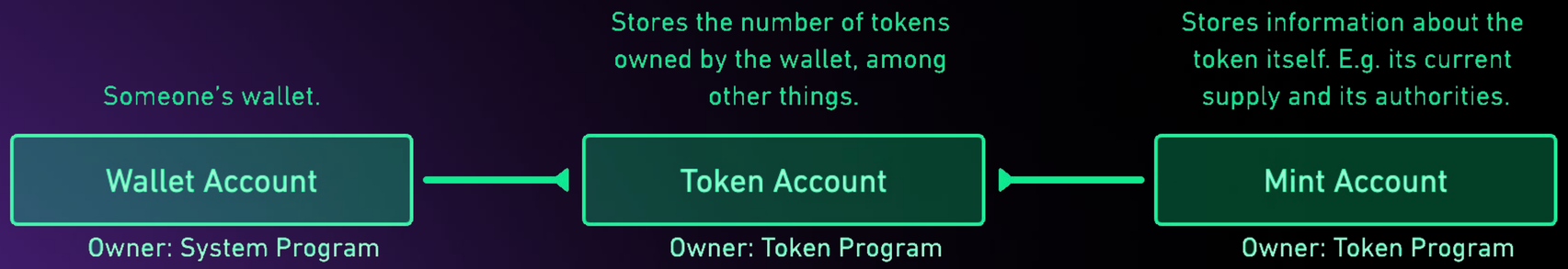
- In case you slept through all of 2021, NFTs were actually one of the biggest accelerators for Solana ecosystem during that year.
- Solana Blockchain surpasses $2 Billion in All-Time NFT Sales (since Q1/2021)
- NFT is a digital asset that represents real-world or digital object.

ackee blockchain



NFT on Solana

- NFT is a mint account with zero decimals and whose supply will never be > 1.
- Token is enhanced with Token Metadata Program (Account), that is used to attach additional data to the token (Via a PDA derived from Mint Account).
- Metadata Account contains all of the on-chain data and links for external off-chain metadata.



Metadata Program

- NFT contains both on-chain data and off-chain data (linked via on-chain URI).
- Most of the basic information is stored on-chain.

  [Mutability Flag, Creator's address, Royalties, Name, Symbol..]
- Other data (usually larger is size) and associated media are usually stored off-chain as a JSON object.
- You are free to use any hosting practice for the off-chain data, even though a distributed storage system like IPFS is recommended.
- Off-chain data should comply to Metaplex Token Standard (similar to ERC-721).

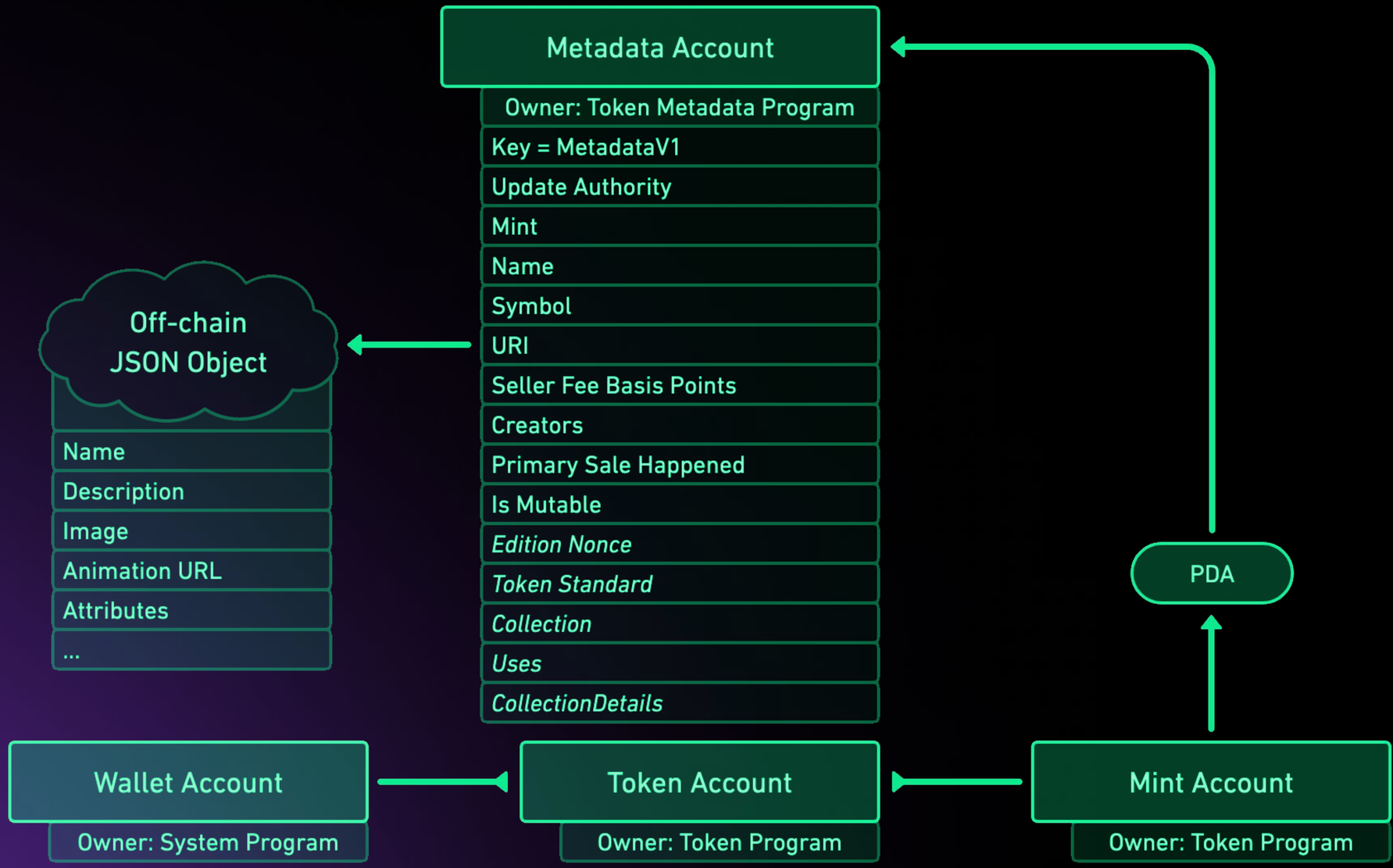


Image source : Metaplex docs (Edited)

NFTs on Solana are very elegant in implementation - Essentially by attaching more data to the Mint Account, the Token Metadata program is able to make “Digital Assets” by extending a regular on-chain Tokens.

Type of metadata

- The Metaplex Standard is compatible with most formats of images, animations, videos, 3d models and even HTML.
- You can use the “properties” field to store other arbitrary data that will be used by specialized applications while maintaining the standard.
- Esentially you can link any arbitrary data/custom data to the NFT, but you will lose compatibility with standardized wallets like Phantom or Solflare.

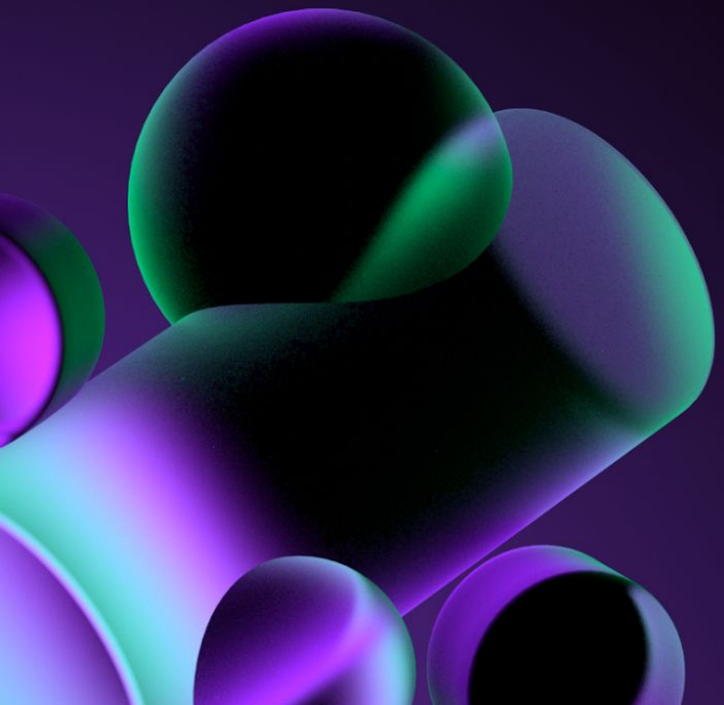
ackee blockchain

Example - NFT represents a game character, extra metadata payload contains characters skill attributes and inventory items, can be mutated only by game server as the player progresses.

METAPLEX

Introduction To Metaplex

Metaplex is an essential collection of tools and programs to make the process of creating NFTs on Solana easier.



What is Metaplex ?

- Solana's NFT ecosystem rapid growth was ignited thanks to Metaplex.
- Metaplex suite offers essential tools for NFT creation, minting and economy.
- Currently, metaplex's primary focus are:
  - **Token Metadata Program** - the NFT standard for Solana;
  - **The Candy Machine [v2]** - Gumball-style candy machines NFT minter (is also what probably caused the Solana network halts);
  - **Auction House** - a decentralized sales protocol for NFT marketplaces.
- Most of the main tools offered have elegant CLI you use to interact with the functionality.

NFT Creation workflow

- Content preparation.
- Upload assets and off-chain data
  - Selecting a proper way to store the off-chain data
- Setting up the mint

Candy Machine Essentials

- Brief explanation
- The Candy Machine is a distribution program used by NFT creators.
  - Pre-set up a collection of NFTs (e.g., 10,000 generated characters).
  - Let user mint a random NFT in the uploaded collection.

The creator first calls InitializeCandyMachine with following “settings” accounts:

```rust
pub struct CandyMachine {
    pub authority: Pubkey,
    pub wallet: Pubkey,
    pub token_mint: Option<Pubkey>,
    pub items_redeemed: u64,
    pub data: CandyMachineData,
    // there's a borsh vec u32 denoting how many actual lines of data there
    // There is actually lines and lines of data after this but we explicitl
    // here there is a borsh vec u32 indicating number of bytes in bitmask a
    // here there is a number of bytes equal to ceil(max_number_of_lines/8)
```

```rust
pub struct CandyMachineData {
    pub uuid: String,
    pub price: u64,
    /// The symbol for the asset
    pub symbol: String,
    /// Royalty basis points that goes to creators in secondary sales (0-10000)
    pub seller_fee_basis_points: u16,
    pub max_supply: u64,
    pub is_mutable: bool,
    pub retain_authority: bool,
    pub go_live_date: Option<i64>,
    pub end_settings: Option<EndSettings>,
    pub creators: Vec<Creator>,
    pub hidden_settings: Option<HiddenSettings>,
    pub whitelist_mint_settings: Option<WhitelistMintSettings>,
    pub items_available: u64,
    /// If [`Some`] requires gateway tokens on mint
    pub gatekeeper: Option<GatekeeperConfig>,
```

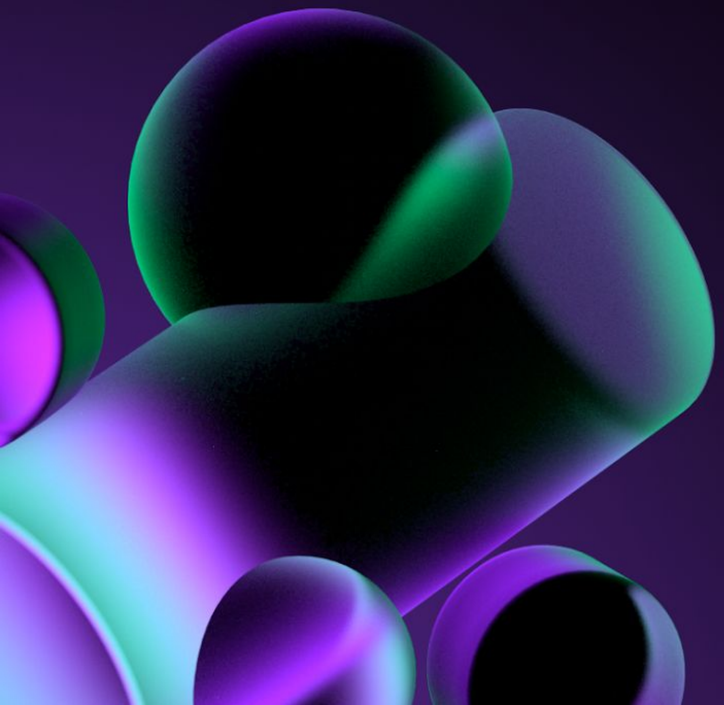
Candy Machine Essentials

- When CM is initialized it can now mint a [random] NFTs via MintNFT instruction.
  - **Step 1 :** Create a new token mint
  - **Step 2:** Create a new metadata account
  - **Step 3:** Set metadata's update_authority to a user-supplied account

```
92  pub fn handle_mint_nft<'info>(
93      ctx: Context<'_, '_, '_, 'info, MintNFT<'info>>,
94      creator_bump: u8,
95  ) -> Result<()> {
96      let candy_machine = &mut ctx.accounts.candy_machine;
97      let candy_machine_creator = &ctx.accounts.candy_machine_creator;
98      // Note this is the wallet of the Candy machine
99      let wallet = &ctx.accounts.wallet;
100     let payer = &ctx.accounts.payer;
101     let token_program = &ctx.accounts.token_program;
```

Hands on Example

Minting your own NFT & Metaplex CM CLI basics



ackee blockchain

https://ssos-mint-page.vercel.app/

Thank you

See you next time!