




# 30-Day Solana Onboarding Guide for Beginners

This curriculum is a 30-day journey designed for the absolute beginner, transforming curiosity into a confident understanding of the Solana ecosystem. Structured with a "learn by doing" philosophy, this plan prioritizes hands-on, UI-based interactions over deep coding to build a strong conceptual foundation. By the end of this month, you will be an informed user, capable of explaining core concepts, navigating key applications, and understanding the strategic importance of Solana's architecture and its major verticals.

Day	Sect ion	Sub -Se ctio n	Sub -Su b-S ecti on	Topi c	Begi nner Expl anat ion	Han ds- On Task	Why This Matt ers	Req uire d Rea ding /Vie win g (AP A)	Opti onal Dee p Dive	Tool / Proj ect Link	Don e? (  /  )
1	1. Fou ndat ions	1.1 Web 3 Prim itive s	1.1.1	Wha t is a Bloc kch ain?	A bloc kch ain is a shar ed, unc han gea ble digit al note boo k. Dat a is	Rea d the "Wh at is Bloc kch ain?" pag e fro m AWS to und erst and	Und erst andi ng this is the first step into Web 3. Unli ke a ban k's priv ate	Ama zon Web Serv ices. (n.d. ). <i>Wha t is bloc kch ain?</i> AWS . Retr ieve d July	Rea d abo ut the diffe renc es bet wee n a bloc kch ain and a tradi tion	<a href="https://aws.amazon.com/what-is/blockchain/">https://aws.amazon.com/what-is/blockchain/</a>	

					stored in "blocks" that are linked together in a "chain." Because everyone in the network has a copy, no single person can alter the records without everyone else agreeing,	the core concepts of decentralization, immutability, and consensus.	ledger, a blockchain is a public record book that isn't controlled by any one company, which removes the need for trusting a middleman <sup>1</sup> .	29, 2024, from <a href="https://aws.amazon.com/what-is/blockchain/">https://aws.amazon.com/what-is/blockchain/</a>	al data base.		
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					making it incredibly secure and transparent. 1						
2	1. Foundations	1.1 Web 3 Primitives	1.1.2	Your First Crypto Wallet	A crypto wallet stores the keys to your digital assets. Think of your public address like your email address (safe to share)	Download and install the Phantom wallet browser extension. Follow the setup guide, create a password, and sec	This is your passport to Web 3. Unlike a bank account, you have full control and ownership of your assets. This power com	NFT Now . (2025, April 7). <i>How to set up and use Phantom's Solana wallet.</i> NFT Now . <a href="https://nftnow.com/guide/how-to-se">https://nftnow.com/guide/how-to-se</a>	Learn about the difference between hot wallets (online) and cold wallets (offline hardware).	<a href="https://phantom.app/download">https://phantom.app/download</a>	✗

					and your private key/seed phrase like your password (never share it). This seed phrase is the master key to all your assets. <sup>2</sup>	urely write down your 12-word Secret Recovery Phrase on paper. <sup>4</sup>	es with the responsibility of securing your own keys.	<a href="#">t-up-and-use-phantom-ms-solana-wall-et/</a>			
3	1. Foundations	1.2 Solana Core Protocol	1.2.1	Proof of History (PoH)	Proof of History (PoH) is Solana's secret sauce for	Visit the Solana Explorer's clock page. Watch	PoH solves the problem of time in a decentralized	Crypto.com University. (2024, December 11). <i>Wha</i>	Read the original Solana whitepaper abstract by	<a href="http://explorer.solana.com/clock">http://explorer.solana.com/clock</a>	✗

					speeded. It's like a super-fast, cryptographic clock that stamps every transaction before the network agrees on it. This creates a verifiable order of events without valid	the "slot" number increases in real-time (about every 400 milliseconds). This is a visual representation of the PoH clock ticking.	network. By ordering transactions first, it dramatically reduces processing bottlenecks, allowing Sola to handle tens of thousands of transactions per second. <sup>6</sup>	<i>this Sola's Proof of History (PoH)? Crypto.com . <a href="http://crypto.com/universities/hat-is-solan-as-proof-of-history-sol-consensus-mechanism">http://crypto.com/universities/hat-is-solan-as-proof-of-history-sol-consensus-mechanism</a></i>	Anatoly Yakovenko. <sup>8</sup>		
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					ators needing to talk to each other about what happened when. <sup>5</sup>						
4	1. Foundations	1.2 Solana Core Protocol	1.2.2	Proof of Stake (PoS)	Proof of Stake (PoS) is the security model that protects the network. Instead of using massive	Explore the list of validators on a site like Solana Beach. Observe metrics like "Total Stake" and	PoS is more energy-efficient than Proof of Work. On Solana, PoH makes the PoS system hyper-e	Phillips, D. (2022). <i>How does Proof-of- History (PoH) work?</i> Coin MarketCap Academy. <a href="http://solana.beach.io/validators">http</a>	Learn about Tower BFT, Solana's specific implementation of PoS.	<a href="http://solana.beach.io/validators">http://solana.beach.io/validators</a>	✗

					com puti ng pow er (Pro of of Wor k), valid ator s "sta ke" their own SOL toke ns as coll ater al to vote on tran sact ions . If they act hon estl y, they earn rew ards ; if they don' t, they risk losin g their	"Upt ime." Noti ce how stak e is distr ibut ed acro ss man y diffe rent valid ator s arou nd the worl d.	ffici ent, as valid ator s sim ply nee d to vote on a pre- orde red seq uen ce of tran sact ions , not argu e abo ut the orde r itsel f. <sup>5</sup>	<a href="https://coinmarketcap.com/academy/article/how-does-proof-of-work-history-works">s://c oin mar ketc ap.c om/ aca dem y/art icle/ how -do es- pro of-o f-hi stor y-p oh- wor k</a>			
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					stake. <sup>9</sup>						
5	1. Foundations	1.2 Solana Core Protocol	1.2.3	Sealevel Parallel Runtime	Sealevel is Solana's engine for parallel processing. Imagine a bank with only one teller versus a bank with hundreds. Because Solana transactions state which	Watch a visual explanation of how Sealevel processes transactions in parallel compared to a single-threaded blockchain.	Sealevel is the other key to Solana's performance. PoH creates the fast-moving queue, and Sealevel provides the multiple lanes to process that queue simultaneously. This	Ackee Blockchain. (2025, July 12). <i>Sealevel</i> . The Solana Book. <a href="https://a.cke.e.xyz/solana/book/latest/chapter2/sealevel/">https://a.cke.e.xyz/solana/book/latest/chapter2/sealevel/</a>	Understand the role of the Berkeley Packet Filter (BPF) as Solana's virtual machine. <sup>12</sup>	<a href="https://www.youtube.com/watch?v=rA5gR8Hk0sQ">https://www.youtube.com/watch?v=rA5gR8Hk0sQ</a>	✗



					accounts they will touch before hand, the network can process thousands of non-overlapping transactions at the same time <sup>12</sup> .		prevents one busy app from slowing down the entire network.				
6	1. Foundations	1.3 Core Tools	1.3.1	Solana Explorer & Devnet	The Solana Explorer is a window into the block	In Phantom, switch your network from	Using the explorer makes the abstract idea	QuickNode. (2025). <i>Solana Explorer by Solana</i>	Try using the Solana Command Line Inter	<a href="https://solfa.ucet.co/ml/">https://solfa.ucet.co/ml/</a>	✗

					<p>chain. It lets you look up any transaction, wallet, or program on the network. Devnet is a test network where developers and users can experiment with fake SOL without any</p>	<p>mainnet Beta" to "Devnet." Use a Devnet Faucet to airdrop 1 free test SOL to your wallet. Then, copy your wallet address, paste it into the Solana Explorer, and find the transaction</p>	<p>of a "public ledger" tangible. You can see for yourself that every action is recorded transparently and permanently on the blockchain, which builds trust in the system.</p>	<p>Solana Labs. QuickNode Guides. <a href="https://www.quicknode.com/builders-guides/tools/solana-explorer-by-solana-labs">https://www.quicknode.com/builders-guides/tools/solana-explorer-by-solana-labs</a></p>	<p>interface (CLI) to request a devnet airdrop (optional, requires installation).</p>		
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					real- world cost . <sup>13</sup>	ion for the airdr op.					
7	1. Fou ndat ions	1.4 Wee k 1 Proj ect	1.4.1	Proj ect: Your First On- Chai n Foot prin t	Con soli date your lear ning fro m Wee k 1 by perf ormi ng a seq uen ce of foun dati onal task s that prov e your abili ty to navi gate the basi c Sola na envi ron men t.	1. Set up Pha nto m wall et. 2. Swit ch to Dev net. 3. Get 1 test SOL fro m a fauc et. 4. Sen d 0.1 test SOL to a frien d's add ress (or a sec ond wall et	This proj ect conf irms you hav e mas tere d the esse ntial skill s for any Sola na user : man agin g a wall et, inter acti ng with diffe rent net wor ks, acq uirin g toke ns,	Sola na Fou ndat ion. (n.d. ). <i>Sola na doc ume ntati on.</i> Sola na Doc s. <a href="http://solanadocs.com/docs">http://solanadocs.com/docs</a>	Expl ore the diffe rent tabs on a tran sact ion pag e in the Expl orer to see wha t data is avail able .	<a href="http://explorer.solanadocs.com/">http://explorer.solanadocs.com/</a>	✗

						you create). 5. Find the transaction on Solana Explorer and save the link.	and verifying actions on-chain.				
8	2. Eco system Verticals	2.1 DeFi	2.1.1	Swapping Tokens with Jupiter	Decentralized Finance (DeFi) offers financial services without traditional banks. Jupiter is a "swap	Connect your Devnet Phantom wallet to Jupiter. Swap 0.2 of your test SOL for some test USD C. Observe	Jupiter's existence highlights Solana's performance. The ability to scan dozens of liquidity pools and	Jupiter Station. (n.d.). <i>How to swap tokens on Jupiter.</i> Jupiter Beta Station. <a href="https://betastation.jup.ag/guide">https://betastation.jup.ag/guide</a>	Look at the "Route" details on Jupiter to see how it sometimes splits your trade across multiple DEX	<a href="https://jup.ag/">https://jup.ag/</a>	✗

					aggregators," meaning it scans all the decentralized exchanges (DEXs) on Solana to find you the best possible price for trading one token for another. <sup>15</sup>	the transaction details before confirming. <sup>16</sup>	execute a complex trade route in a single, fast transaction is only possible on a high-speed, low-fee network.	<a href="#">des/jupiter-swap/swaps</a>	s to get the best price.		
9	2. Ecosystem	2.1 DeFi	2.1.2	Advanced	Drift is a full-	Connect your	Complex	Drift Protocol	Read about	<a href="https://app.drift.trade">https://app.drift.trade</a>	✗

	em Verti cals			DeFi with Drift	serv ice dece ntral ized exch ange on Sola na offe ring more adv anced pro duct s like per petu al futu res (tra ding on the futu re pric e of an asse t), borr owi ng, and lend ing. It ope	wall et to Drift . Expl ore the UI: view the diffe rent mar kets (e.g. , SOL -PE RP), look at the "Len d/B orro w" tab to see curr ent inter est rate s, and view your acc ount heal th with out mak ing a	platf orm s like Drift , whic h man age thou sands of cros s-m argi ned posi tion s sim ulta neo usly, are a test ame nt to Seal evel' s para llel proc essi ng. The y dem onst rate that Sola na can	. (n.d. ). <i>Intr odu ctio n</i> . Drift Prot ocol Doc s. <a href="https://docs.drift.trade/">https://docs.drift.trade/</a>	ut Drift 's diffe rent liqui dity mec hani sms (JIT Auct ion, Ord erb ook, AM M).  17	<a href="#">drift.trade/</a>	
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					rate s like a prof essi onal tradi ng platf orm, but fully on- chai n. <sup>17</sup>	trad e. <sup>18</sup>	sup port fina ncia l appl icati ons as sop histi cate d as thos e in tradi tion al fina nce.				
10	2. Eco syst em Verti cals	2.2 NFT s	2.2.1	The NFT Mar ketp lace : Mag ic Ede n	Non -Fu ngib le Tok ens (NF Ts) are uniq ue digit al certi ficat es of own ersh ip for item s like art,	Con nect your wall et to Mag ic Ede n. Bro wse a pop ular coll ecti on. Use the filter s on the left- han d	Sola na's extr eme ly low tran sact ion fees crea ted the perf ect envi ron men t for a vibr ant NFT mar ket.	Mag ic Ede n Com m unit y. (n.d. ). <i>How to crea te and sell your own NFT.</i> Mag ic Ede n. <a href="http://c">http ://c</a>	Expl ore the "Lau nch pad " or "Dro ps" sect ion to see upc omi ng NFT mint s.	<a href="http://magiceden.io/">http :// mag iced en.i o/</a>	✗

					collectibles, or even in-game items, all secured on the blockchain. Magic Eden is the largest marketplace for buying, selling, and discovering NFTs on Solana. <sup>19</sup>	side to sort by attributes (e.g., "backgrounder") and see how the floor price changes. <sup>19</sup>	It made minting and trading large collections economically viable, which was a major catalyst for user growth on the network.	<a href="https://community.magiceden.io/learn/how-to-create-and-sell-your-own-nft">om mun ity. mag iced en.i o/le arn/ how -to- crea te-a nd- sell- your -ow n-nf t</a>			
11	2. Eco system	2.2 NFTs	2.2.2	The NFT Standard	Metaplex is the	Browse the Met	Metaplex's ope	QuickNode. (202	Read about	<a href="https://github.com">https://github.com</a>	✗



	Verti cals			: Met aple x	und erlyi ng tech nolo gy stan dard for mos t NFT s on Sola na. It's an ope n-so urce prot ocol that prov ides the tool s for crea tors to laun ch coll ecti ons and for mar ketp lace s like Mag ic Ede n to	aple x repo sitor y on GitH ub to see the ope n-so urce cod e that pow ers Sola na NFT s. You don' t nee d to und erst and the cod e, just app reci ate that it's a publ ic goo d for all dev	n-so urce stan dard was cruc ial for the rapi d gro wth of the Sola na NFT eco syst em. It crea ted a com mon tool set, prev enti ng frag men tatio n and allo win g dev elop ers to inno vate on	4, April 1). <i>What is Met aple x Core and how to mint your first Core NFT.</i> Quic kNo de Gui des. <a href="https://www.quicknode.com/guides/solanad-evalopment/nfts/what-is-metaple-x-core-and-how">https://www.quicknode.com/guides/solanad-evalopment/nfts/what-is-metaple-x-core-and-how</a>	Met aple x's new "Core" stan dard , whic h is desi gne d to be che aper and mor e flexi ble.	<a href="https://www.quicknode.com/guides/solanad-evalopment/nfts/what-is-metaple-x-core-and-how">m/m etap lex-f oun dati on/ met aple x-pr ogra m-li brar y</a>	
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					display the m. Think of it as the "operating system" for Solana NFTs. <sup>20</sup>	developers.	top of a shared, secure foundation.	<a href="#">-to-mint-your-first-core-nft</a>			
12	2. Ecosystem Verticals	2.3 Week 2 Project	2.3.1	Project: Mint Your First NFT	Experience the process of creating a new digital asset on the blockchain and taking ownership of it in your	Find a free or very low-cost NFT mint on Magic Eden's Launchpad (or a similar platform). Complete	This project makes the concept of digital ownership tangible. You are not just buying an asset; you are	Magic Eden Community. (n.d.). <i>How to mint an NFT: A simple step-by-step guide</i> . Magic Eden.	Look up your newly minted NFT on the Solana Explorer to see its on-chain data and metadata.	<a href="https://magiceden.io/launchpad">https://magiceden.io/launchpad</a>	✗

					wallet.	the minting process on Devnet if possible, or Mainnet for a free mint.	participating in its creation on the public ledger, an experience unique to Web 3.	<a href="https://community.magiceden.io/learn/how-to-mint-an-nft">https://community.magiceden.io/learn/how-to-mint-an-nft</a>			
13	2. Ecosystem Verticals	2.4 Payments	2.4.1	Solana Pay: The Future of Commerce	Solana Pay is a protocol for merchants to	Visit the official Solana Pay documentation	Solana Pay is a direct challenge to the exist	Solana Foundation. (n.d.). <i>Solana Pay doc</i>	Read about Solana Pay's "Transaction	<a href="https://docs.solana.org/">https://docs.solana.org/</a>	✗

					accept digital payments directly from customers with near-zero fees and instant settlement. It uses QR codes or links to create a seamless checkout experience, bypassing tradi-	page. Scan the example QR code with your Phantom wallet's scanner. Observe the payment request screen that appears (you don't need to approve the transaction).	ing payments that charge merchants 2-3% and take days to settle. It leverages Sola's speed and low cost to create a more efficient and global commerce infrastructure.	s. Sola na. <a href="https://docs.solanapay.com/">https://docs.solanapay.com/</a>	n Request s" feature, which allows for more complex interactions like minting an NFT at the point of sale.		
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					<p>           tion            al            pay            men            t            net            wor            ks            like            Visa            or            Mas            terc            ard.            21         </p>						
14	2. Eco syst em Verti cals	2.5 Wee k 2 Revi ew	2.5.1	Revi ew: The Sola na Eco nom y	Revi ew the key verti cals expl ored : DeFi (sw appi ng, lend ing), NFT s (ma rket plac es, stan dard s), and Pay men ts.	Writ e dow n one key take awa y for eac h verti cal (De Fi, NFT s, Pay men ts) and how it ben efits fro m Sola na's core	This synt hesi s con nect s the dots bet wee n the tech nolo gy (We ek 1) and the appl icati ons (We ek 2), reinf orci ng why	Sola na. (n.d. ). <i>Eco syst em</i> . Sola na New s. <a href="http://solanam/news/tag/ecosystem">http://solanam/news/tag/ecosystem</a>	Expl ore the full Sola na Eco syst em map to see the hun dre ds of othe r appl icati ons bein g built .	<a href="http://solanam/ecosystem">http://solanam/ecosystem</a>	✗

						architect ure.	Sola na's perf orm anc e unlo cks spe cific  , high -gro wth use cas es.				
15	3. Adv anc ed Verti cals	3.1 DeP IN	3.1.1	DeP IN Part 1: Heli um & The Phy sical Worl d	DeP IN stan ds for Dec entr alized Phy sical Infra stru ctur e Net wor ks. The se proj ects use token rew ards to	Go to the Heli um Expl orer map . Zoom in on your city or regi on and see the net wor k of acti ve hot spots prov	DeP IN is a revo lutio nary mod el for boo tstra ppin g infra stru ctur e. Inst ead of one com pan y spe ndin g billio	Heli um Fou ndat ion. (n.d. ). <i>Ove rvie w of the Heli um Net wor k.</i> Heli um Doc s. <a href="http://docs.heli.com/home/">http://docs.heli.com/home/</a>	Rea d abo ut the diffe rent toke ns in the Heli um eco syst em: HNT , IOT (for IoT devi ces) , and MO BILE (for 5G). 25	<a href="http://explorer.helium.com/">http://explorer.helium.com/</a>	✗

					incentivize people to build and operate real-world infrastructure. Helium is a decentralized wireless network powered by individuals running hotspots <sup>24</sup> .	iding wireless coverage, all run by individuals.	ns, Helium uses crypto incentives to coordinate thousands of people, building a global network faster and cheaper than traditional methods.	<a href="#">about-helium/</a>			
16	3. Advanced	3.1 DePIN	3.1.2	DePIN Part 2:	DePIN is a dive	Explore the Step	The example	dePIN Hub. (n.d.	Read about	<a href="https://stepn.co">https://stepn.co</a>	✗

	Verticals			Step n & Nos ana	re cate gory . Step n is a "Move-to-Earn" app where users earn tokens for walking or running, turning personal activity data into a resource . <sup>26</sup> Nos ana is a decentralized GPU net	n web site to understand the game mechanics. Then, visit the Nos ana web site and view their net work stats to see how much GPU power is being contributed by the community.	es show the breadth of DePIN. Any decentralized physical or digital resource—from your daily steps to your gaming PC's GPU—can be organized and monetized through a decentralized	). Nos ana. dePIN Hub. <a href="https://depinhub.io/projects/nosana">https://depinhub.io/projects/nosana</a>	the "DePIN Flywheel," the economic model where token incentives drive network growth, which in turn increases the token's value. <sup>28</sup>	<a href="#">m/</a>	
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					work where users rent out their idle computer power for AI and rendering tasks. <sup>27</sup>		distributed network on a performant blockchain like Solana.				
17	3. Advanced Verticals	3.2 Week 3 Project	3.2.1	Project: Querying DePIN Data	Demonstrate the "data" layer of DePIN networks by directly accessing their public	Use a public API endpoint from a DePIN project like DePINsc an. Simply open	This task shows that DePIN networks are not just abstract concepts; they are real, functional	DePINsc an. (n.d.). <i>Quickstart</i> . DePINsc an Documentation. <a href="https://docs.depinscan.io/de">https://docs.depinscan.io/de</a>	Use a free online JSON viewer to paste the raw data into a more readable format	<a href="https://apidemoscan.io/api/v1/projects">https://apidemoscan.io/api/v1/projects</a>	✗

					information through an API endpoint.	the provided URL in your browser to see the raw JSON data about the network's status. No coding is required, just observation.	tioning systems generating verifiable data that is open and accessible to anyone, reinforcing the principle of transparency.	<a href="#">velo per/ map -integration/ quickstart</a>	mat.		
18	3. Advanced Verticals	3.3 DAOs & Governance	3.3.1	Intro to DAOs with Realms	A DAO is a Decentralized Autonomous Organization	Go to the Realms website and explore the list	DAOs represent a new model for human coordination	QuickNode. (2025, July 9). <i>How to create a DAO</i>	Read the SPL Governance documentation to	<a href="http://app.realms.toda.y/">http://app.realms.toda.y/</a>	✗

					ation—a n inter- net- nati- ve orga- niza- tion man- age d by its me- mbe- rs, with rule s enfo- rced by cod- e. Real ms is the prim- ary platf- orm on Sola- na for crea- ting and man- agin- g DAO s, han- dlin	of publ- ic DAO s. Clic- k into a few (like Man- go or Jito) to see their trea- suri- es, me- mbe- r lists, and past pro- pos- als.	dina- tion. Platf- orm s like Real- ms prov- ide the tool s to run an orga- niza- tion tran- spar- entl- y and glob- ally, with deci- sion s bein- g mad- e by a com- mun- ity rath- er than a cent- ral auth- ority	on Sola- na usin- g Real- ms. Quic- kNo- de Gui- des. <a href="http://www.quicknode.com/guides/solana-developer/3rd-party-integration/s/dato-with-realms">http://www.quicknode.com/guides/solana-developer/3rd-party-integration/s/dato-with-realms</a>	und- erst- and the on- chai- n pro- gra- m that pow- ers Real- ms.
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					g ever ythi ng fro m voti ng to trea sury man age men t. <sup>29</sup>						
19	3. Adv anc ed Verti cals	3.3 DAO s & Gov erna nce	3.3. 2	Proj ect: Part icip ate in a DAO Vote	Mak e the con cept of on- chai n gov erna nce tang ible by part icip atin g in the dec ision -ma king proc ess of a real DAO .	Find a publ ic DAO on Real ms with an acti ve pro pos al. Con nect your wall et, read the pro pos al and the com mun ity	This proj ect mov es you fro m a pas sive obs erve r to an acti ve part icip ant in a dec entr alize d com mun ity. It dem onst	Med ium. (202 5, April 14). <i>Real ms: Dem ocra tizin g DAO part icip atio n on Sola na.</i> Tob a. <a href="http://medium.com/@tobs.x/realms">http://medium.com/@tobs.x/realms</a>	Expl ore the Jito DAO 's publ ic foru m to see how pro pos als are disc usse d befo re they are put to an on- chai n vote	<a href="http://a.pp.realmstudio.com/discov">http://a.pp.realmstudio.com/discov</a> <a href="http://a.pp.realmstudio.com/discov">er</a>	✗

						discuss around it. If you hold the required governance token, cast a vote. If not, simply observe the process and the vote tally.	rates the power of having a direct say in the future of a protocol or project.	<a href="#">s-demo-crating-daoparticipation-on-solanaf9173f9f896c</a>	.		
20	3. Advanced Verticals	3.3 DAOs & Governance	3.3.3	Multi-Sig Security with Squads	A multi-sig nature (or "multi-sig") wallet requires	Watch a video tutorial on how to create and man	Squads provides the critical security layer for DAOs	Squads Protocol. (2025, June 9). <i>Quickstart guid</i>	Read about the formal verification of the Squ	<a href="https://app.squads.io/">https://app.squads.io/</a>	✗

					multiple people to approve a transaction before it can be sent. Squads is a platform that makes it easy for teams and DAOs to use multi-sig wallets to securely manage their funds. <sup>32</sup>	manage a Squad. Observe the interface for proposing and approving transactions.	and project treasures. While Realms is for making decisions, Squads is for securely executing those decisions, preventing a single person from controlling the funds	e. Squads Docs. <a href="http://docs.squads.so/main/getting-started/quickstart-guide">http://docs.squads.so/main/getting-started/quickstart-guide</a>	ads protocol, a mathematical proof of its security. <sup>32</sup>		
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							and prot ecti ng agai nst thef t or loss.				
21	3. Adv anc ed Verti cals	3.4 Wee k 3 Revi ew	3.4.1	Revi ew: DeP IN & Gov erna nce	Revi ew the con cept s of DeP IN (bo otst rap ping phy sical infra struc ture with toke ns) and Gov erna nce (ma king dec ision s and man agin g fund s	Expl ain to a frien d (or writ e dow n) the diffe renc e bet wee n Real ms and Squ ads, and how a DeP IN proj ect like Heli um mig ht use both	Sola na's low fees are criti cal for both of thes e verti cals. The y mak e it affo rdab le for DeP IN devi ces to repo rt data freq uent ly and for thou	Sola na. (n.d. ). <i>DAO s and gov erna nce.</i> Sola na Doc s. <a href="http://solanalabs.com/demos/dao">http://solanalabs.com/demos/dao</a>	Expl ore a DAO that gov erns a DeP IN proj ect to see the inter sect ion of thes e two con cept s.	<a href="http://solanalabs.com/demos/dao">http://solanalabs.com/demos/dao</a>	✗

					on-chain).	.	sands of DAO members to participate in governance without high costs.				
22	4. The Cutting Edge	4.1 Consumer & Mobile	4.1.1	Backpack & xNFs	Backpack is a wallet built around a new concept: xNFs, or "executable NFTs." An xNF is like a	Install the Backpack wallet. Explore the built-in xNF library (the "four-square" icon) to see exa	xNFs could revolutionize the Web3 user experience. Instead of connecting your wallet to potentially	CoinGeko. (2025, March 6). <i>What is Backpack and how to interact with its ecosystem for points.</i>	Read the xNF Developer documentation to understand and how they are built.	<a href="http://backpack.kap/">http://backpack.kap/</a>	✗



					normal NFT but with code inside, turning it into a mini-application that runs directly with in your wallet, like an operating system. <sup>34</sup>	implies of applications running natively inside the wallet.	risky websites, you run the app securely inside your wallet. This is a major step forward for security and usability. <sup>37</sup>	Coin Gecko. <a href="https://www.coin Gecko.com/learn/what-is-backpack-crypto-exchange-wallet-potential-airdrop">https://www.coin Gecko.com/learn/what-is-backpack-crypto-exchange-wallet-potential-airdrop</a>			
23	4. The Cutting Edge	4.1 Consumer & Mobile	4.1.2	Solana Mobile & Seeker	Solana Mobile is an initiative to build a	Visit the Solana Mobile website and revi	A dedicated Web 3 phone aims to	Solana Mobile. (n.d.). <i>Solana Seeker</i> .	Learn about TEE PIN (Trusted Executive	<a href="https://solanamobile.com/">https://solanamobile.com/</a>	✗

					Web 3-native smartphone. The upcoming "Seeker" phone features a "Sealed Vault"—a hardware-secure area for your private keys—and a dApp Store that provides a better distr	ew the specifications for the Seeker phone. Watch the announcement video to understand the vision.	solve the biggest friction points for crypto on mobile: security and user experience. It represents a strategic move to create a superior, integrated environment for the next wave of	Solana Mobile. <a href="https://solana.com/seeker">https://solana.com/seeker</a>	on Environment Platform Infrastructure Network), the broader vision for Solana Mobile.		
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					tribution channel for crypto apps. <sup>38</sup>		consumer dApps. <sup>39</sup>				
24	4. The Cutting Edge	4.2 AI & Content	4.2.1	Audius & Decentralized Content	Audius is a decentralized music streaming service built partially on Solana. It aims to give artists more control and a larger share of	Create an account on Audius and listen to some tracks. Explore the platform and notice how it functions like a traditional streaming	Decentralized content platforms like Audius can create fairer economic models for creators. This is only possible on a chain like Solana	Solana. (n.d.). <i>Audius</i> (\$AUDI) on Solana: A beginner's guide. Solana. <a href="https://www.soladex.io/project/audius">https://www.soladex.io/project/audius</a>	Read about how Audius uses both Ethereum and Solana for different parts of its protocol. <sup>44</sup>	<a href="https://audius.co/">https://audius.co/</a>	✗

					revenue by removing intermediaries. It uses the blockchain to track plays and distribute payments directly. <sup>41</sup>	service, but with a decentralized backend. <sup>43</sup>	na that can handle millions of low-cost microtransactions (e.g. , per-second streaming payments).				
25	4. The Cutting Edge	4.3 ReFi & RWA s	4.3.1	Tok enizing the Real World	Real -World Assets (RW As) are physical or traditional fina	Read the Heli us overview on RWA s on Sola na. Explore a	RWA s are the bridge between the multi-trillion dollar	Heli us. (2025, June 23). <i>Real world assets on Sola na:</i>	Explore Sola na's Token Extensions, a new standard that ena	<a href="https://ondo.finance/">https://ondo.finance/</a>	✗

					ncial l asse ts (like real esta te, stoc ks, or treas ury bills ) that are repr ese nted as toke ns on the bloc kch ain. This proc ess, call ed toke niza tion, can mak e illiqu id asse ts easy to trad e	proj ect like Ond o Fina nce to see exa mpl es of toke nize d U.S. Trea suri es.	tradi tion al fina nce mar ket and DeFi . ReFi (Re gen erati ve Fina nce) uses thes e sam e tool s to fund proj ects with posi tive envi ron men tal or soci al imp act, like carb on cred it mar kets	A com preh ensi ve over view . Heli us Blog . <a href="https://www.heli.us.dev/blog/solar-real-world-assets">https://www.heli.us.dev/blog/solar-real-world-assets</a>	bles feat ures requ ired for RWA s like tran sfer hoo ks and conf iden tial tran sfer s. <sup>48</sup>		
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					and own frac tion ally. 45		47				
26	4. The Cutt ing Edg e	4.4 Infra stru ctur e & Dev Tool ing	4.4.1	The Dev elop er's Tool kit	A brief , con cept ual over view of the tool s that pow er the eco syst em. Anc hor is a fra me wor k that mak es buil ding in Rust safe r and fast er. 49	Bro wse the web sites for Anc hor, Sea hors e, and Heli us. You don' t nee d to und erst and the cod e, just reco gniz e the nam es and their one -sen tenc e pur	A rich dev elop er eco syst em is a lead ing indi cator of a bloc kch ain's heal th. The se tool s lowe r the barr ier to entr y for dev elop ers fro m diffe rent	101 Bloc kch ains. (202 4, Jan uary 25). <i>Solana tuto rial: An intro duction to Anc hor.</i> 101 Bloc kch ains. <a href="http://101blockchains.com/solana-anchors/">http://101blockchains.com/solana-anchors/</a>	Wat ch an intro duct ory vide o on buil ding with Anc hor on Solana Play grou nd.	<a href="http://www.anchor-lang.com/">http://www.anchor-lang.com/</a>	✗

					Sea hors e lets develop ers use Python. <sup>50</sup>	pos e.	bac kgro und s, crea ting a flyw heel effe ct of mor e app s, whic h attr acts mor e user s.				
					Sola ng lets the m use Soli dity. <sup>51</sup>						
					Heli us prov ides high -per for man ce data APIs <sup>52</sup> .						
27	4. The Cutt ing Edg e	4.5 Futu re of the Prot ocol	4.5.1	Alpe nglo w: The Next Lea p	Alpe nglo w is a mas sive upc omi ng upg rade to Sola	Rea d the Heli us blog post expl aini ng upg rade to Sola	The mai n ben efit for user s is a ~10 0x redu ctio	Heli us. (202 5, May 26). <i>Alpe nglo w: Sola na's grea t</i>	Rea d abo ut Anz a, the new soft war e develop	<a href="http://www.anza.xyz/">http://www.anza.xyz/</a>	✗

					na's core protocol . Its key components , Votor (voting) and Rotor (data propagation), will replace legacy systems like Tower BFT and PoH , dramatically improving performance	simple terms.	n in transaction finality time , from over 10 seconds to around 150 milliseconds. This will make Solana's performance comparable to centralized Web 2 systems , enabling a	consensus rewrite. Helius Blog . <a href="https://www.helius.dev/blog/alpenglow">https://www.helius.dev/blog/alpenglow</a>	ment firm spun out from Solana Labs that is leading the development of Alpenglow. <sup>56</sup>		
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					e. <sup>53</sup>		new clas s of real -tim e appl icati ons. 55				
28	5. Synt hesi s	5.1 The Big Pict ure	5.1.1	The Sola na Valu e Pro posi tion	A revi ew of Sola na's core arch itect ural adv anta ges. The "per for man ce flyw heel " of PoH and Seal evel crea tes a high -thr oug hput , low- late	Revi ew your note s fro m Day 3, 4, and 5. Writ e a shor t para grap h expl aini ng how PoH and Seal evel wor k toget her to mak e Sola na	This com bina tion of high perf orm anc e and low cost is not just an incr eme ntal impr ove men t; it ena bles entir e cate gori es of appl icati ons	Yak ove nko, A. (201 7). <i>Sola na: A new arch itect ure for a high perf orm anc e bloc kch ain.</i> Sola na Whit epa per. <a href="http://solan.a.com/solan-a-w">http://solan.a.com/solan-a-w</a>	Re-r ead the Sola na whit epa per abst ract and see how the origi nal visio n con nect s to the eco syst em you' ve expl ored. 58	<a href="http://solan.a.com/">http://solan.a.com/</a>	✗

					ncy network. This translates into an economic advantage: ultra-low transaction fees.	fast.	(high-frequency DeFi, large-scale NFT mints, DePIN) that are simply not feasible on slower, more expensive blockchains.	<a href="#">hitepaper.pdf</a>			
29	5. Synthesis	5.1 The Big Picture	5.1.2	Composability & The User Experience	Composability is the idea that apps in an ecosystem	Think of three examples of how different verti	Solana's single-shard architecture makes compos	Solana Foundation. (n.d.). <i>Solana ecosystem</i> .	Explore a project like Kamino Finance that com	<a href="https://a.pp.kamino.fi/nance/">https://a.pp.kamino.fi/nance/</a>	✗

					em can inter act with eac h othe r like "mo ney lego s." On Sola na, an NFT can be your tick et into a DAO , a toke nize d RWA can be use d as coll ater al in DeFi , and a DeP IN net wor	cals you' ve lear ned abo ut coul d be com bine d. (e.g. , A Step n sne aker NFT that give s you voti ng pow er in their DAO ).	abili ty sea mle ss. Bec aus e all appl icati ons live on the sam e glob al stat e mac hine , they can inter act with eac h othe r easil y and ato mic ally, lead ing to pow erful net wor k effe	Sola na. <a href="http://solanam/e/cosystem">http://solanam/e/cosystem</a>	pos es with man y othe r DeFi prot ocol s to crea te auto mat ed yiel d strat egie s.		
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					k can pay out rew ards via Sola na Pay.		cts and inno vativ e new pro duct s.				
30	5. Synt hesi s	5.2 Cap ston e Proj ect	5.2.1	Proj ect: The DeP IN Dat a NFT	Co mbi ne your kno wle dge of DeP IN, NFT s, and Pay men ts into a singl e, coh esiv e proj ect that dem onst rate s your und erst andi ng	Co mpl ete the Mini -Ca psto ne Proj ect: 1. Que ry DeP IN data via a publ ic API. 2. Mint an NFT repr ese ntin g that data . 3. Cre ate a Sola	This proj ect prov es you can navi gate acro ss mult iple Sola na verti cals. It synt hesi zes your und erst andi ng of how data fro m the phy sical worl	Shyf t. (202 2, Oct obe r 7). <i>Part 1: Buil d your first Sola na NFT mar ketp lace</i> . Shyf t Blog s. <a href="https://blogs.shyft.to/build-your-first-nft-main">https://blogs.shyft.to/build-your-first-nft-main</a>	Try crea ting a sec ond NFT with data fro m a diffe rent DeP IN net wor k.	See Cap ston e Proj ect Det ails Belo w	✗

					of the Sola na eco syst em.	na Pay link to "sell " the NFT.	d (De PIN) can be repr ese nted as a uniq ue on- chai n asse t (NF T) and mad e com mer ciall y avail able thro ugh a dec entr alize d pay men t syst em (Sol ana Pay) .	<a href="#">rket plac e-2 e52f 24a e7e c</a>			
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This project combines three major Solana verticals—DePIN, NFTs, and Payments—into a single, beginner-friendly workflow that requires no coding. You will capture data from a real-world decentralized network, turn it into a unique digital asset, and create a way to sell it using decentralized payments.

**Objective:** To mint an NFT that represents a snapshot of a DePIN network's status and create a Solana Pay QR code for it.

### Tools Needed:

- A web browser
- Your Phantom Wallet (on Mainnet, but no real funds needed for the payment link)
- An NFT minting tool (e.g., the free tool on Magic Eden's Creator Hub)
- A free Solana Pay QR Code Generator

### Step-by-Step Guide:

#### 1. Query DePIN Data:

- Open your web browser and navigate to a public DePIN API endpoint. A simple one is the Helium Network Stats API: <https://api.helium.io/v1/stats>.
- This page will show raw JSON data with statistics like the current number of hotspots.
- Take a screenshot of this data. This screenshot will be the "art" for your NFT.
- **Tutorial Citation:** Dennis, C. (2023, February 6). *APIs for beginners - How to use an API (Full course / tutorial)* [Video]. YouTube.  
<https://www.youtube.com/watch?v=WXsDOZgxjRw>

#### 2. Mint the Data NFT:

- Go to the **Magic Eden Creator Hub** (or a similar simple minting tool).
- Connect your Phantom wallet.
- Start the process to create a new, single NFT (not a collection).
- **Upload:** Use the screenshot of the Helium stats you just took as the image for your NFT.
- **Name:** Give it a descriptive name, like "Helium Network Snapshot - July 29, 2024".
- **Description:** Write a brief description, such as "A snapshot of the Helium network stats, captured on. Total hotspots: [find the number in your screenshot]."
- Mint the NFT. This will likely cost a very small amount of SOL in transaction fees.

- Once minted, view your new NFT in your Phantom wallet's "Collectibles" tab.
- **Tutorial Citation:** Magic Eden Community. (n.d.). *How to create and sell your own NFT*. Magic Eden.

<https://community.magiceden.io/learn/how-to-create-and-sell-your-own-nft>

### 3. Create a Solana Pay Link:

- Now that you have your NFT, you can create a payment link to "sell" it.
- Go to a free Solana Pay QR Code Generator tool like the one provided by Dialect.
- **Recipient:** Enter your own Solana wallet address (you're "selling" it to yourself as a demo).
- **Amount:** Enter a price, for example, 0.1 SOL.
- **Memo:** In the memo or reference field, paste the link to your NFT on the Solana Explorer. You can get this link by finding the NFT in your wallet and clicking "View on Explorer."
- Generate the QR code. Save the image of the QR code.
- **Tutorial Citation:** QuickNode. (2025, July 9). *How to build a payment portal with Solana Pay in your web app*. QuickNode Guides.

<https://www.quicknode.com/guides/solana-development/solana-pay/add-solana-pay-to-your-web-app>

**Final Deliverable:** You have successfully completed the project when you have:

1. The screenshot of the DePIN data.
2. A link to your minted NFT on the Solana Explorer.
3. The generated Solana Pay QR code image.

This capstone project demonstrates a complete, cross-vertical workflow on Solana, solidifying the concepts you've learned over the past 30 days.

### Works cited

1. What is Blockchain Technology? - Blockchaining Explained - AWS, accessed July 30, 2025, <https://aws.amazon.com/what-is/blockchain/>
2. www.investopedia.com, accessed July 30, 2025, <https://www.investopedia.com/terms/b/bitcoin-wallet.asp#:~:text=A%20cryptocurrency%20wallet%20is%20a,coins%20associated%20with%20that%20address.>
3. Cryptocurrency Wallet: What It Is, How It Works, Types, and Security, accessed July 30, 2025, <https://www.investopedia.com/terms/b/bitcoin-wallet.asp>
4. How to Set Up and Use Phantom's Solana Wallet - NFT Now, accessed July 30, 2025, <https://nftnow.com/guides/how-to-set-up-and-use-phantoms-solana-wallet/>
5. What Is Solana's Proof of History? SOL's Unique Consensus ..., accessed July 30,

2025,

<https://crypto.com/en/university/what-is-solanas-proof-of-history-sol-consensus-mechanism>

6. What Is Solana's Proof of History? A Beginner's Guide - Unchained Crypto, accessed July 30, 2025, <https://unchainedcrypto.com/solana-proof-of-history/>
7. Solana 101: Proof of History Explained - Purpose Investments, accessed July 30, 2025, <https://www.purposeinvest.com/funds/crypto/knowledge-base/solana-101-proof-history-explained>
8. Solana Whitepaper - Web3 Jobs, accessed July 30, 2025, <https://web3.career/learn-web3/solana-whitepaper>
9. www.fidelity.com, accessed July 30, 2025, <https://www.fidelity.com/learning-center/trading-investing/proof-of-work-vs-proof-of-stake#:~:text=Proof%20of%20work%20and%20proof,via%20a%20lottery%20like%20system.>
10. How Does Proof-of-History (PoH) Work? - CoinMarketCap, accessed July 30, 2025, <https://coinmarketcap.com/academy/article/how-does-proof-of-history-poh-work>
11. SOLANA 101: - Its History, Future, and Features - Purpose Investments, accessed July 30, 2025, <https://documents.purposeinvest.com/Docs/Misc/whitepaper/en/Solana%20101%20Whitepaper.pdf?ref=thoughtful.purposeinvest.com>
12. Sealevel - Ackee Blockchain, accessed July 30, 2025, <https://ackee.xyz/solana/book/latest/chapter2/sealevel/>
13. Solana Explorer by Solana labs | QuickNode, accessed July 30, 2025, <https://www.quicknode.com/builders-guide/tools/solana-explorer-by-solana-labs>
14. Introduction to the Solana CLI - Agave Validator Documentation, accessed July 30, 2025, <https://docs.anza.xyz/cli/intro>
15. Jupiter Exchange Solana DeX Tutorial - With Phantom Wallet (Full Guide 2025) - YouTube, accessed July 30, 2025, <https://www.youtube.com/watch?v=albe-4NterY>
16. How to Swap Tokens on Jupiter, accessed July 30, 2025, <https://betastation.jup.ag/guides/jupiter-swap/swap>
17. What is Drift Protocol (DRIFT)| How To Get & Use Drift Protocol ... - Bitget, accessed July 30, 2025, <https://www.bitget.com/price/drift-protocol/what-is>
18. Drift docs, accessed July 30, 2025, <https://docs.drift.trade/>
19. How to Create And Sell Your Own NFT: A Beginner's Guide, accessed July 30, 2025, <https://community.magiceden.io/learn/how-to-create-and-sell-your-own-nft>
20. Metaplex Guides and Resources - QuickNode, accessed July 30, 2025, <https://www.quicknode.com/guides/tags/metaplex>
21. docs.solanapay.com, accessed July 30, 2025, <https://docs.solanapay.com/#:~:text=Solana%20Pay%20is%20a%20standard,into%20their%20apps%20and%20services.>



22. Solana Pay | Solana Pay Docs, accessed July 30, 2025,  
<https://docs.solanapay.com/>
23. Overview | Solana Pay Docs, accessed July 30, 2025,  
<https://docs.solanapay.com/core/transaction-request/overview>
24. docs.helium.com, accessed July 30, 2025,  
<https://docs.helium.com/home/about-helium/#:~:text=The%20Helium%20Network%20is%20a,Solana%20Blockchain%20for%20its%20foundation.>
25. Home | Helium Documentation - Helium Docs, accessed July 30, 2025,  
<https://docs.helium.com/home/about-helium/>
26. www.kucoin.com, accessed July 30, 2025,  
<https://www.kucoin.com/learn/crypto/how-stepn-gmt-lets-you-earn-while-making-you-fit#:~:text=In%20STEPN%2C%20earning%20cryptocurrency%20is,accurate%20tracking%20of%20your%20movements.>
27. Nosana - About - DePIN Hub, accessed July 30, 2025,  
<https://depinhub.io/projects/nosana>
28. Unpacking DePIN: A beginner's guide to Decentralized Physical Infrastructure | by San Clemente | Aleph Cloud | Medium, accessed July 30, 2025,  
<https://medium.com/aleph-im/a-beginners-guide-to-decentralized-physical-infrastructure-2f5896d92556>
29. How to Create a DAO on Solana using Realms | QuickNode Guides, accessed July 30, 2025,  
<https://www.quicknode.com/guides/solana-development/3rd-party-integrations/dao-with-realms>
30. Realms: Democratizing DAO Participation on Solana. | by Toba - Medium, accessed July 30, 2025,  
<https://medium.com/@tobs.x/realms-democratizing-dao-participation-on-solana-f9173f9f896c>
31. Spl Governance – Docs - Realms, accessed July 30, 2025,  
<https://docs.realms.today/spl-governance>
32. Secure Signing Process on Squad Protocol: Incidents, CLI, Best Practices. - Medium, accessed July 30, 2025,  
<https://medium.com/@glitztechglitz/securing-squads-4f43944e4c59>
33. Quickstart Guide | Squads Docs, accessed July 30, 2025,  
<https://docs.squads.so/main/getting-started/quickstart-guide>
34. Backpack token airdrop guide - Boxmining, accessed July 30, 2025,  
<https://boxmining.com/backpack-token-airdrop-guide/>
35. www.alwin.io, accessed July 30, 2025,  
[https://www.alwin.io/what-are-xnfts#:~:text=Executable%20NFTs%20\(xNFTs\)%20are%20an,actions%20or%20trigger%20events%20autonomously.](https://www.alwin.io/what-are-xnfts#:~:text=Executable%20NFTs%20(xNFTs)%20are%20an,actions%20or%20trigger%20events%20autonomously.)
36. What is Backpack? - Delphi Digital, accessed July 30, 2025,  
<https://members.delphidigital.io/projects/backpack>
37. What Is Backpack And How To Interact With Its Ecosystem for Points ..., accessed July 30, 2025,  
<https://www.coingecko.com/learn/what-is-backpack-crypto-exchange-wallet-potential-airdrop>

38. Solana Seeker | The Definitive Web3 Mobile Device, accessed July 30, 2025, <https://solanamobile.com/seeker>
39. What Is Solana Seeker Phone, and How to Buy It? | KuCoin Learn, accessed July 30, 2025, <https://www.kucoin.com/learn/crypto/what-is-solana-seeker-phone-and-how-to-buy>
40. Solana Mobile | The Web3 Mobile Evolution, accessed July 30, 2025, <https://solanamobile.com/>
41. What Is Audius & How Does It Work? Who Created AUDIO? - Kriptomat, accessed July 30, 2025, <https://kriptomat.io/cryptocurrency-prices/audius-audio-price/what-is/>
42. Audius (AUDIO): Price, Market Analysis & Trends - Coinmetro, accessed July 30, 2025, <https://www.coinmetro.com/price/audio>
43. Audius (\$AUDIO) on Solana: A Beginners Guide - Soladex, accessed July 30, 2025, <https://www.soladex.io/project/audius>
44. Is Audius on the Solana or Ethereum Network?, accessed July 30, 2025, <https://support.audius.co/help/Is-Audius-on-the-Solana-or-Ethereum-Network-5f596>
45. Real-World Assets on Solana: The Race to Bring Wall Street Onchain | by Joel varghese, accessed July 30, 2025, <https://medium.com/@varghesejoel6/real-world-assets-on-solana-the-race-to-bring-wall-street-onchain-f27e631e031c>
46. Real World Assets on Solana: A Comprehensive Overview - Helius, accessed July 30, 2025, <https://www.helius.dev/blog/solana-real-world-assets>
47. Solana DApps: Unleashing the Power of Decentralized Applications - Webisoft, accessed July 30, 2025, <https://webisoft.com/articles/solana-dapps/>
48. Token Extensions | Solana, accessed July 30, 2025, <https://solana.com/solutions/token-extensions>
49. Solana Tutorial: An Introduction to Anchor - 101 Blockchains, accessed July 30, 2025, <https://101blockchains.com/solana-anchor/>
50. The Seahorse Language | Seahorse Lang, accessed July 30, 2025, <https://www.seahorse.dev/using-seahorse/the-seahorse-language>
51. Solang Solidity Compiler - Read the Docs, accessed July 30, 2025, <https://solang.readthedocs.io/>
52. Welcome to Helius - Helius Docs, accessed July 30, 2025, <https://www.helius.dev/docs>
53. Alpenglow: Solana's Largest Protocol Upgrade Ever | Brennan Watt, Anza, accessed July 30, 2025, <https://solanacompass.com/learn/Lightspeed/alpenglow-solanas-largest-protocol-upgrade-ever-brennan-watt-anza>
54. figment.io, accessed July 30, 2025, <https://figment.io/insights/alpenglow-solanas-new-consensus-protocol-built-for-real-time-blockchains/#:~:text=Votor%3A%20a%20high%2Dspeed%20consensus,coding%20to%20eliminate%20bandwidth%20bottlenecks.>
55. Alpenglow: Solana's Great Consensus Rewrite - Helius, accessed July 30, 2025,

<https://www.helius.dev/blog/alpenglow>

56. Anza | Solana Network Opportunities Job Board, accessed July 30, 2025,

<https://jobs.solana.com/companies/anza-2>

57. Anza, accessed July 30, 2025, <https://www.anza.xyz/>

58. Solana Whitepaper - ICDEF, accessed July 30, 2025,

<https://icdef.co.uk/solana-whitepaper/>