Blockchain Training



An initiative of the Lagos State Ministry of Education

Week 1

What is CodeLagos?



- CodeLagos is an initiative of the Lagos State Ministry of Education aimed at making coding education accessible to Lagos State residents.
- The program launched a successful pilot phase in 2017 with 23 Government schools and 32 Private schools. Since then, it has expanded to 130 Government schools and 145 Private schools.
- Started with 4 Out of School centres but has since expanded to 12 with the introduction of Blockchain Technology.



How We Got Here





Decade of Women Hackathon



Course Content



- Overview of Blockchain (Ethereum)
- Solidity Programming
- Launching a Node to setup a Blockchain project
- Creation and Deployment of Smart Contracts
- Creation of a Crytotoken



The Goal





Ability to Create Your Own Smart Contracts



We Don't Cover



- Cryptocurrency speculation
- Bitcoin





What is a Blockchain?

- A blockchain is a fully-distributed, peer-to-peer software network which makes use of cryptography to securely host applications, store data, and easily transfer digital instruments of value that represent real-world money.
- Cryptography is the art of communication via coded messages.



Simulating a Blockchain



Debit (Expenditure)	Credit (Income)
\$10 Soldier 1	\$10 Doctor
\$5 Hunter 1	\$5 Blacksmith
\$5 Hunter 2	\$5 Blacksmith
\$1 Cook	\$1 Engineer
\$1 Architect	\$1 Engineer
\$1 Doctor	\$1 Engineer
\$1 Gardener	\$1 Engineer
\$1 Soldier 1	\$1 Engineer
\$1 Soldier 2	\$1 Engineer
\$1 Blacksmith	\$1 Engineer
\$1 Hunter 1	\$1 Engineer
\$1 Hunter 2	\$1 Engineer
\$10 Gardener	\$10 Hunter 1
\$5 Gardener	\$5 Hunter 2



Simulating a Blockchain



https://hackernoon.com/why-decentralized-consensus-blockchain-is-good-for-business-5ff263468210

https://hackernoon.com/how-to-run-a-blockchain-on-a-deserted-island-with-pen-and-paper-899949ec555b



Cryptocurrencies and Blockchain

"Bitcoin" can indicate:

- •The currency –bitcoin or BTC
- •The technology that enables the cryptocurrency to be exchanged-Bitcoin

Blockchain: computational principles and technologies that enable cryptocurrencies and other use-cases









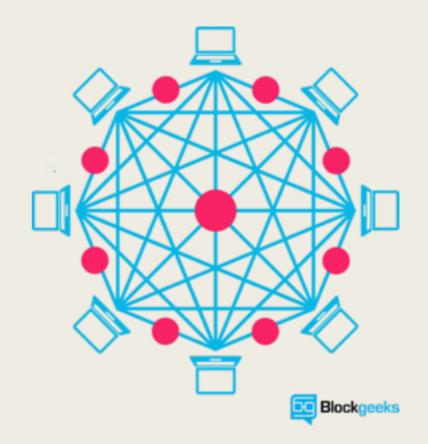




Key Concepts



- •Consensus: independent validation among multiple parties
- •Secure chain of data: transparency and auditability
- •Transactions: transfer of ownership of data, assets etc.





Kinds of Blockchain



Blockchains are categorized according to participants:

- Public if anybody can join the network (permission less)
- Private if participants need permission to join



Industries Ripe for Disruption

- Identity Management
- Healthcare
- Law & Intellectual Property
- Proof-of-Ownership
- Digital Assets & their Marketplaces
- Scientific Journals and Reviews



Disruptive Potential



- Removing Human Corruptibility
- Bypassing Human Inefficiency
- Automating the World
- Rapidly Prototyping Distributed Systems



Use Cases Around the World

- Bitpesa Remittances
- AidTech Tracking of Payment
- Consent Digital ID
- Seso Real Estate Marketplace



Bitpesa



- Forex/Money
 Conversion
- Using Crytocurrencies as a means of exchange
- Greatly reduces cost





Aidtech



- Issuance of Digital ID to those in need
- Tracking of funds throughout process
- Transparent donations, remittances and aid





Consent



- Digital identity on the Blockchain
- Ownership of one's personal information
- Ability to give consent to others





Seso



- Digital Extended Land Registry on Blockchain
- Marketplace for all land transactions





Conclusion



- The Blockchain revolution is just getting started
- We can either take the bus or get left behind
- There is enormous opportunity for developers in this space
- The world over there is a shortage of Blockchain developers
- Understanding the core infrastructure of the Blockchain gives you a head start as a developer

Setting Up Your Development Environment

- Bitcoin has a Blockchain
- We will be using Ethereum to learn about the Blockchain
- Ethereum is programmable unlike Bitcoin



Setting Up Your Development Environment

- Geth
- Ganache
- Node
- Truffle
- Solidity
- Visual Studio Code
- Git





- Geth is a command line interface that allows you to run a full Ethereum node.
- It is implemented in Go and allows you to mine blocks, to generate ether, to deploy and interact with smart contracts.
- It can connect to the public Ethereum like the main net or to create your own private network for development purposes.



Download Geth - Sacrosancter (v1.8.10) - Release Notes

You can download the latest 64-bit stable release of Geth for our primary platforms below. Packages for all supported platforms, as well as develop builds, can be found further down the page. If you're looking to install Geth and/or associated tools via your favorite package manager, please check our installation guide.

🐧 Geth 1.8.10 for Linux

Geth 1.8.10 for macOS

₹ Geth 1.8.10 for Windows

P Geth 1.8.10 sources

https://ethereum.github.io/go-ethereum/ downloads/





Download Geth - Sacrosancter (v1.8.10) - Release Notes

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💍 Geth 1.8.10 for Linux

Geth 1.8.10 for macOS

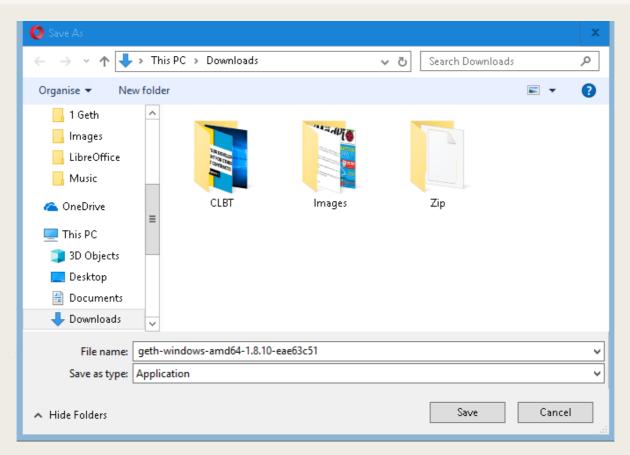
∉ Geth 1.8.10 for Windows

P Geth 1.8.10 sources

Click the Windows Link



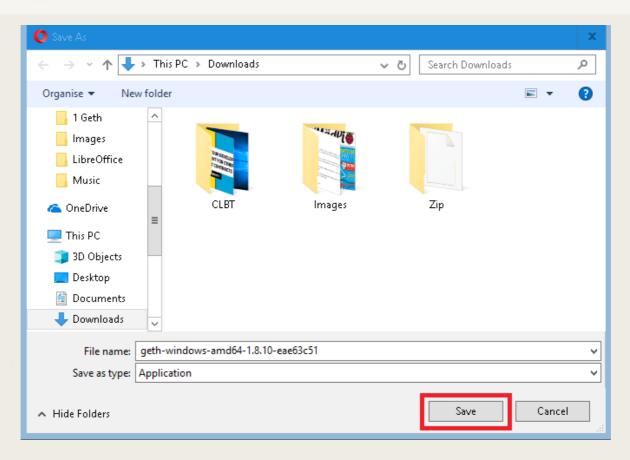




The Popup Opens



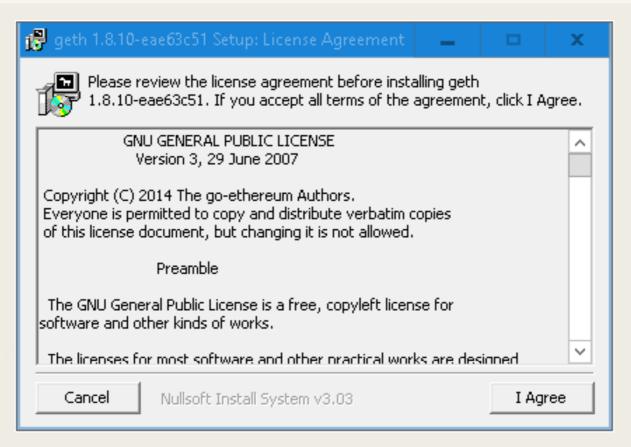




Click on Save to Begin Download



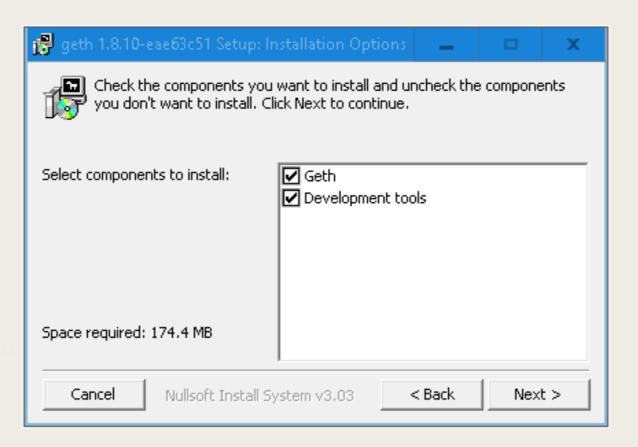




Begin Installation



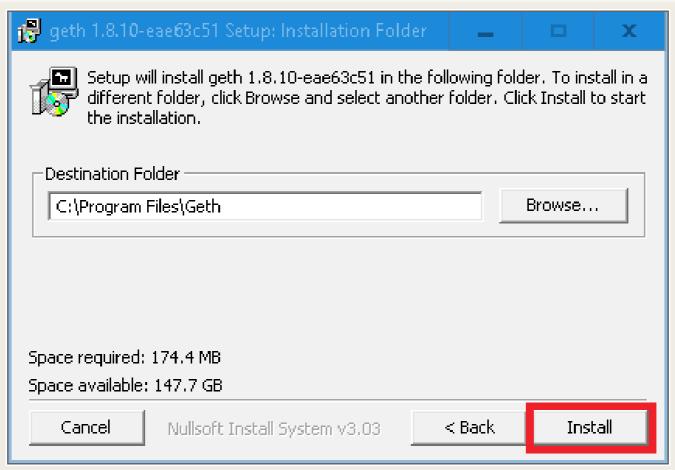




Check the Development Tools Option



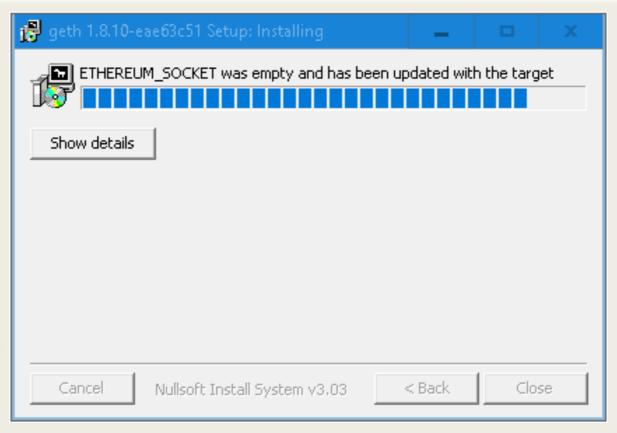




Click Install



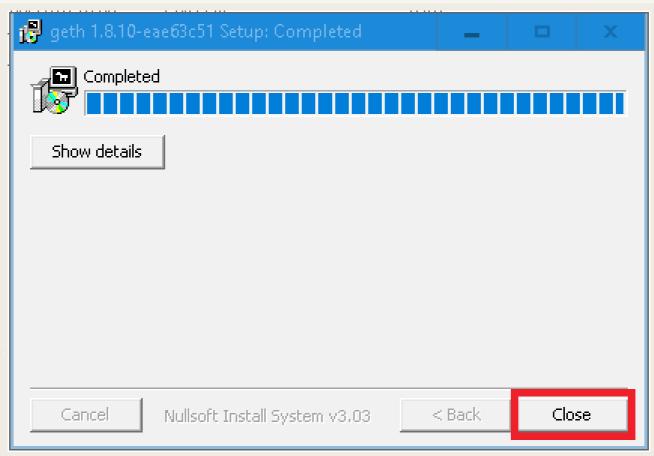




Wait for the Installation to finish







Close the Dialog



Test in Powershell



```
PS C:\Users\Truston Ailende> geth version
Geth
Version: 1.8.10-stable
Git Commit: eae63c511ceafab14b92e274c1b18bf1700e2d3d
Architecture: amd64
Protocol Versions: [63 62]
Network Id: 1
Go Version: go1.10.2
Operating System: windows
IGOPATH=
GOROOT=C:∖go
PS C:\Users\Truston Ailende>
```



Ganache

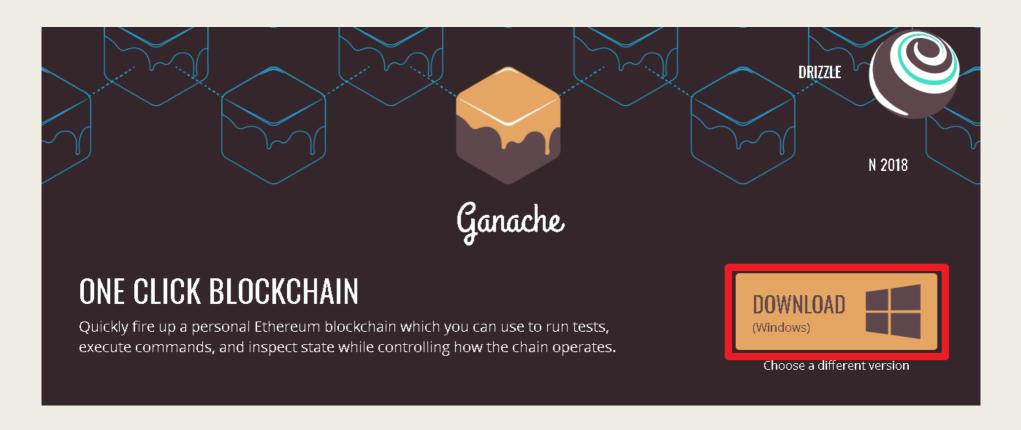


- Ganache is an ethereum blockchain emulator that you can use for development purposes
- It has a UI that allows you to inspect blocks and transactions
- It allows you test your contracts locally



Ganache



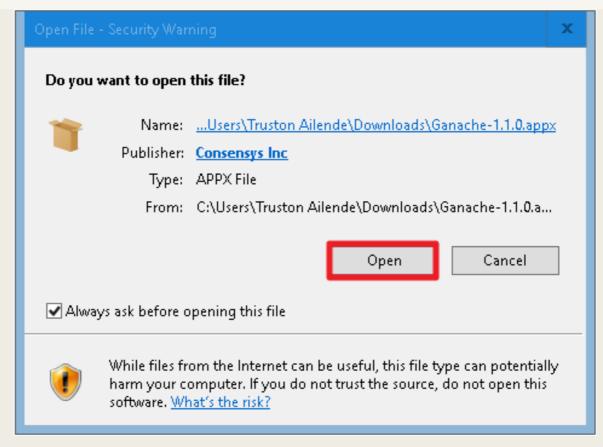


truffleframework.com/ganache



Ganache



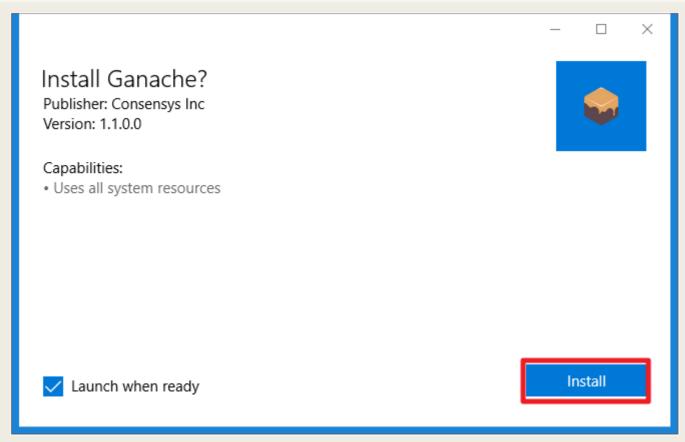


Run the Program



Ganache





Start the Installation



Ganache



SUPPORT GANACHE

Ganache includes Google Analytics tracking to help us better understand how you use it during your normal development practices. You can opt-out of this tracking by selecting the option below.

By enabling this feature, you provide the Truffle team with valuable metrics, allowing us to better analyze usage patterns and add new features and bug fixes faster.

Thanks for your help, and happy coding!

-- The Truffle Team

WHAT WE TRACK

- · A unique UUID generated upon first use
- Window width and height
- Ganache version
- Exception messages (without paths)
- · Screens viewed during use

We do not collect addresses or private keys.



Analytics enabled. Thanks!

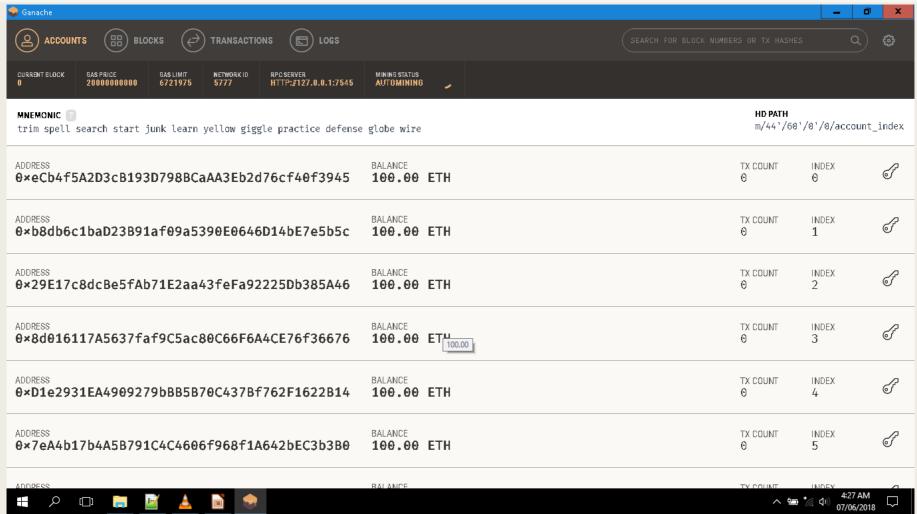


Click the Continue Button



Ganache





Installation Successful





- Node is a server side JavaScript platform to create applications that will interact with your Ethereum node
- To know if Node is on your machine, in Powershell, type in the following command:

node -v

If you see an error, it means that Node isn't installed





Node.js® is a JavaScript runtime built on Chrome's V8 JavaScript engine. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient. Node.js' package ecosystem, npm, is the largest ecosystem of open source libraries in the world.

June 2018 Security Releases

Download for Windows (x64)

8.11.2 LTS

Recommended For Most Users

Other Downloads | Changelog | API Docs

10.4.0 Current

Latest Features

Other Downloads | Changelog | API Docs

nodejs.org





Node.js® is a JavaScript runtime built on Chrome's V8 JavaScript engine. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient. Node.js' package ecosystem, npm, is the largest ecosystem of open source libraries in the world.

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Recommended For Most Users

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10.4.0 Current

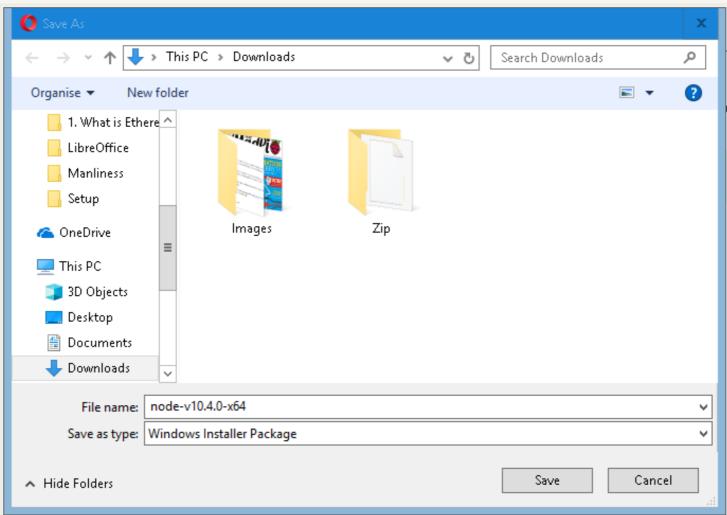
Latest Features

Other Downloads | Changelog | API Docs

Click to start download



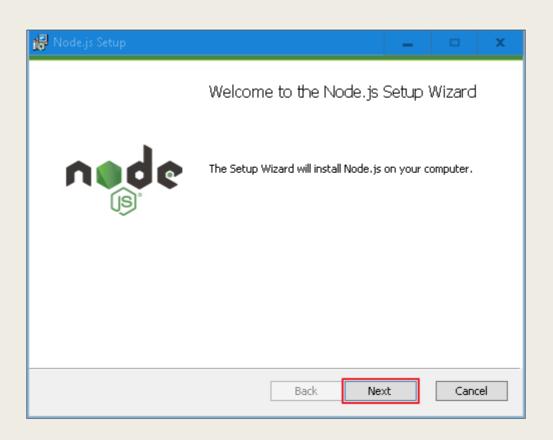




Popup opens



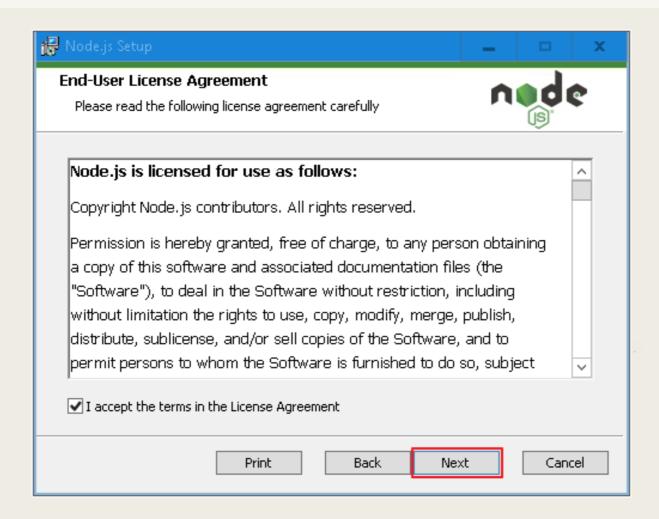




Start Download







Accept License Agreement



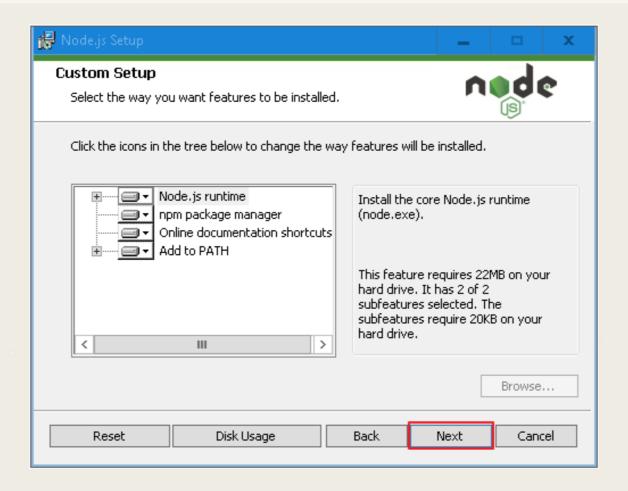


Node.js Setup	_ □ X
Destination Folder Choose a custom location or click Next to install.	nede
Install Node.js to:	
C:\Program Files\nodejs\ Change	
Back No	ext Cancel

Destination Folder



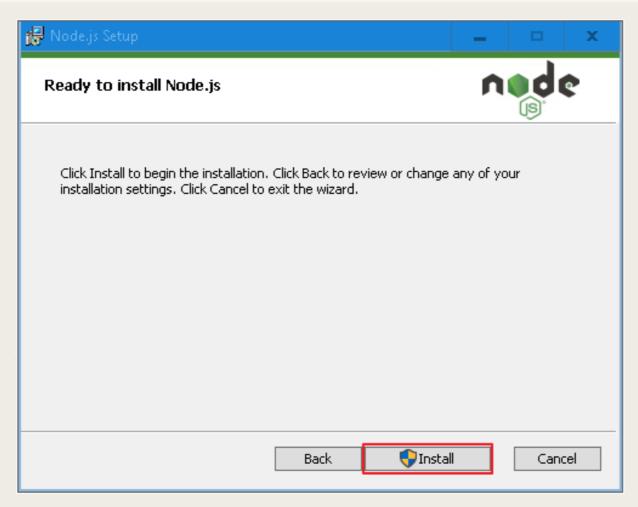




Accept Defaults







Begin Installation



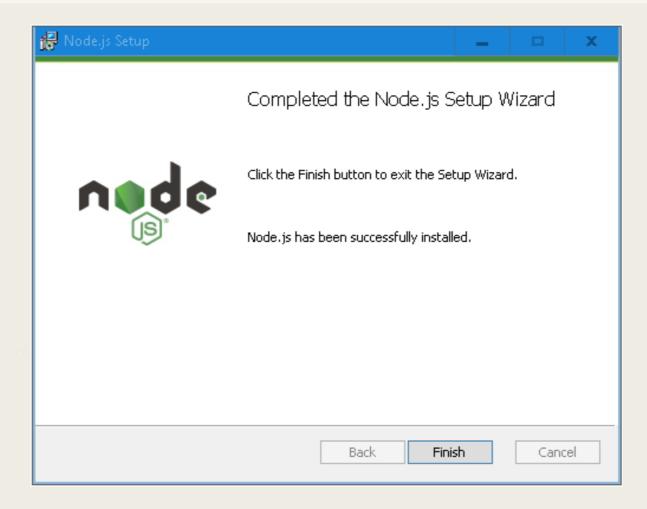


Node.js Setup	-	п	x
Installing Node.js	ń		¢
Please wait while the Setup Wizard installs Node.js.			
Status:			_
Back Ne	xt	Can	cel

Setup Begins







Installation Successful



Truffle



- To compile, test and deploy your smart contracts, you need a build framework that will increase your development speed
- If you have a previous version, uninstall it in Powershell using the code shown below:

npm uninstall -g truffle

Install a recent version in Powershell using the command shown below:

npm install -g truffle



Truffle



```
PS C:\Users\Truston Ailende> npm install -g truffle
C:\Users\Truston Ailende\AppData\Roaming\npm\truffle -> C:\Users\Truston Ailende
\AppData\Roaming\npm\node_modules\truffle\build\cli.bundled.js
+ truffle@4.1.11
added 81 packages from 309 contributors in 59.713s
PS C:\Users\Truston Ailende> truffle version
Truffle v4.1.11 (core: 4.1.11)
Solidity v0.4.24 (solc-js)
PS C:\Users\Truston Ailende>
```

Installation Successful



Solidity



- Solidity is a contract-oriented programming language for writing smart contracts
- Solidity is a statically-typed programming language designed for developing smart contracts that run on the EVM
- Solidity is compiled to bytecode that is executable on the EVM



Solidity



In Powershell, type this command:
 npm install -g solc

```
PS C:\Users\Truston Ailende> npm install -g solc
C:\Users\Truston Ailende\AppData\Roaming\npm\solcjs -> C:\Users\Truston Ailende\AppData\
Roaming\npm\node_modules\solc\solcjs
+ solc@0.4.24
added 66 packages from 31 contributors in 20.915s
```



Solidity



```
PS C:\Users\Truston Ailende> solcjs
Must provide a file
PS C:\Users\Truston Ailende>
```

Test Your Installation

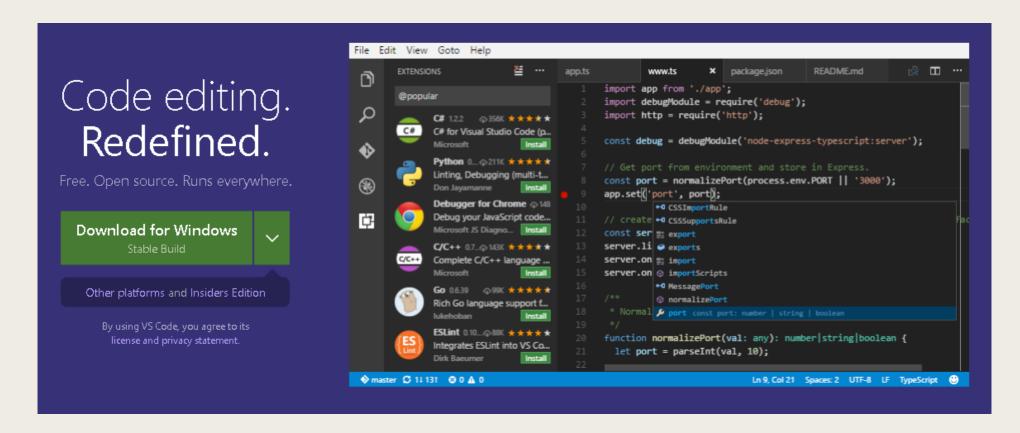




- Visual Studio Code is a source code editor developed by Microsoft for Windows, Linux and MacOS.
- It includes support for debugging, embedded Git control, syntax highlighting, intelligent code completion, snippets, and code refactoring.
- We will use it for syntax highlighting of our Solidity code



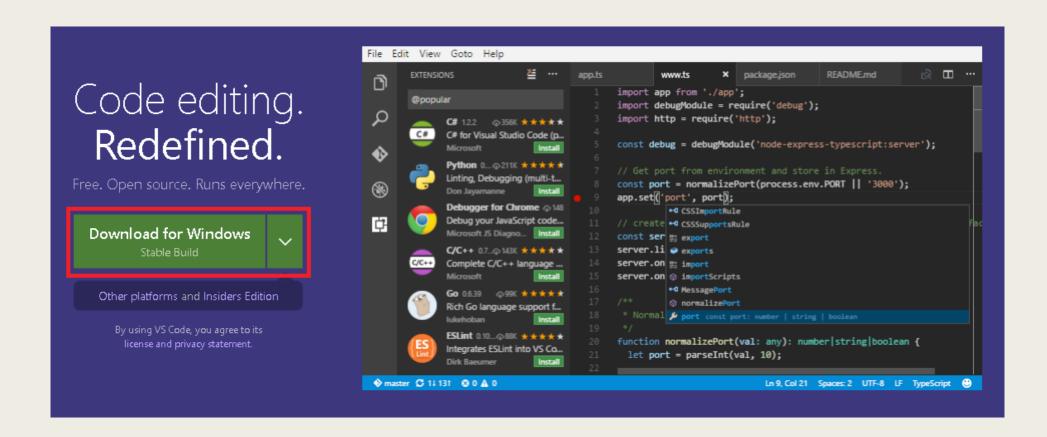




https://code.visualstudio.com



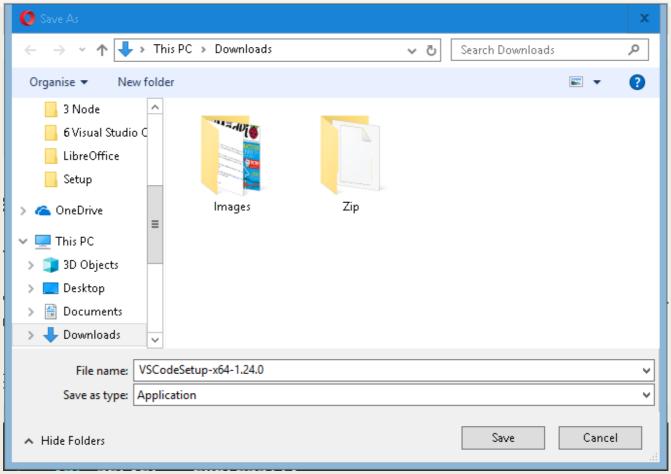




Click to Download



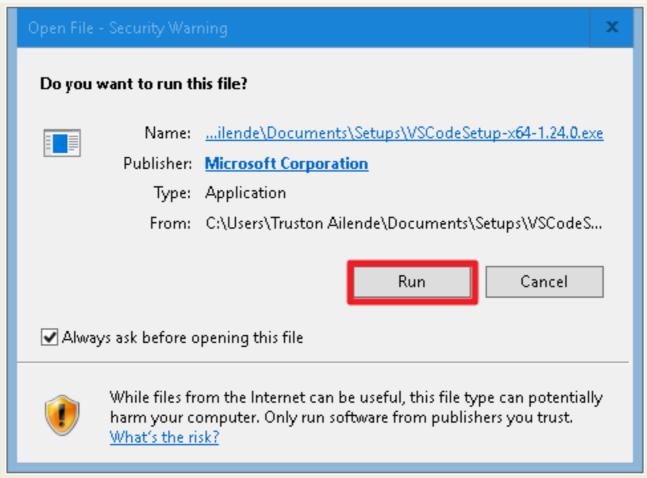




Popup comes up



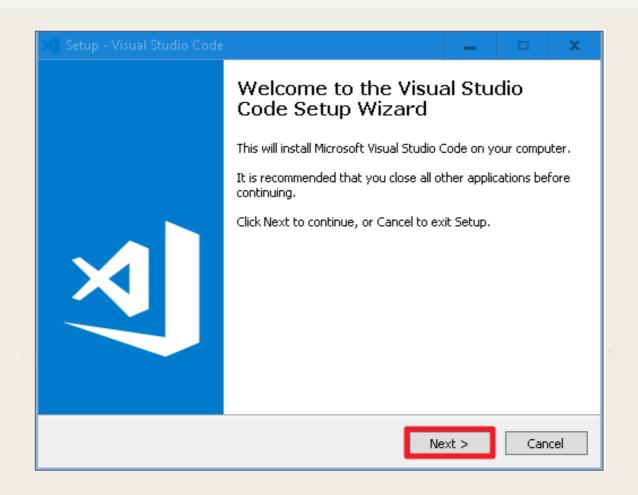




Run the Program







Start Your Installation





Setup - Visual Studio Code	□ X
License Agreement Please read the following important information before continuing.	X
Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.	_
MICROSOFT SOFTWARE LICENSE TERMS MICROSOFT VISUAL STUDIO CODE	Â
These license terms are an agreement between Microsoft Corporation (or based on where you live, one of its affiliates) and you. They apply to the software named above. The terms also apply to any Microsoft services or updates for the software, except to the extent those have different terms.	
IF YOU COMPLY WITH THESE LICENSE TERMS, YOU HAVE THE RIGHTS BELOW.	
1. INSTALLATION AND USE RIGHTS.	~
I accept the agreement	
O I do not accept the agreement	
< Back Next >	Cancel

Accept the License Agreement



Setup - Visual Studio Code	-		-	×
Select Destination Location Where should Visual Studio Code be installed?			>	1
Setup will install Visual Studio Code into the following folder	′ .			
To continue, click Next. If you would like to select a different folder,	click i	Browse		
C:\Program Files\Microsoft VS Code		Brows	в	
At least 214.5 MB of free disk space is required.				
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Accept Default Destination





💢 Setup - Visual Studio Code	-		х
Select Start Menu Folder Where should Setup place the program's shortcuts?			M
Setup will create the program's shortcuts in the following	Start Me	nu folder	
To continue, click Next. If you would like to select a different folde	r, click B	rowse.	
Visual Studio Code		Browse	
☐ Don't create a Start Menu folder			
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Start Menu Folder



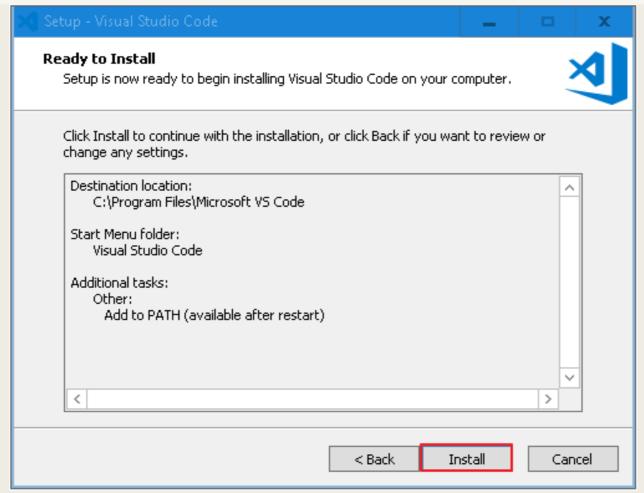


Setup - Visual Studio Code	_		х	
Select Additional Tasks Which additional tasks should be performed?			M	
Select the additional tasks you would like Setup to perform while in Code, then click Next.	stalling Vi	sual Stud	lio	
Additional icons:				
Create a desktop icon				
Other:				
Add "Open with Code" action to Windows Explorer file context	: menu			
Add "Open with Code" action to Windows Explorer directory context menu				
Register Code as an editor for supported file types				
✓ Add to PATH (available after restart)				
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Additional Tasks



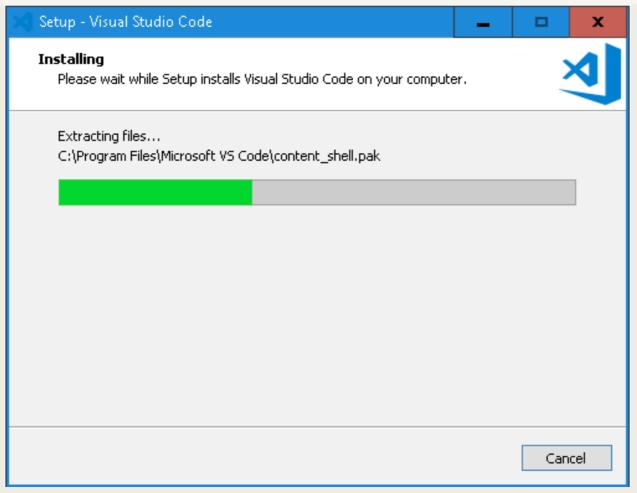




Start Installation



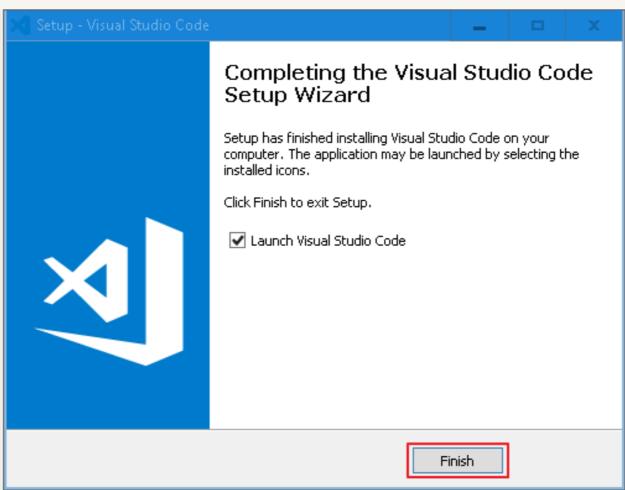




Installation in Progress



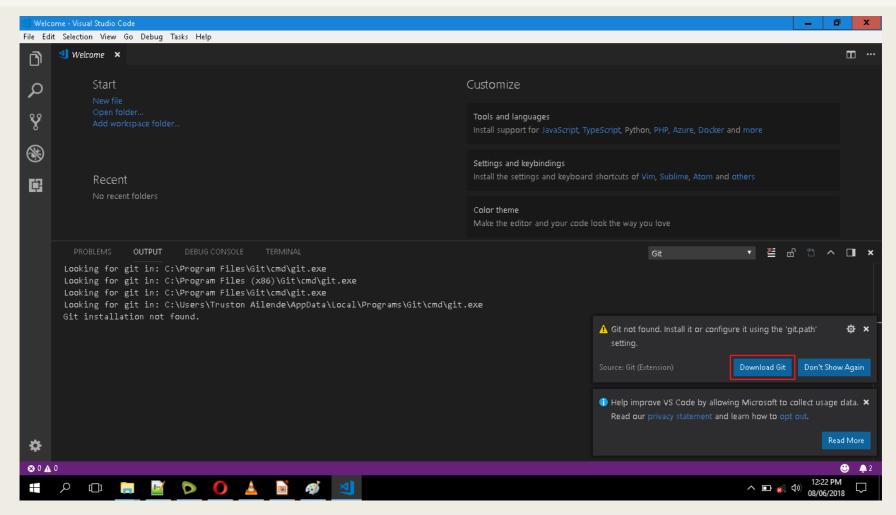




Installation Completed



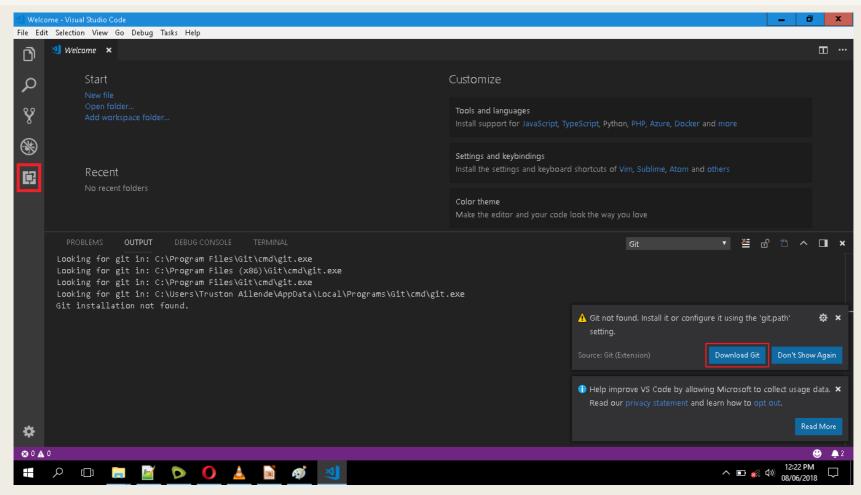




First Run



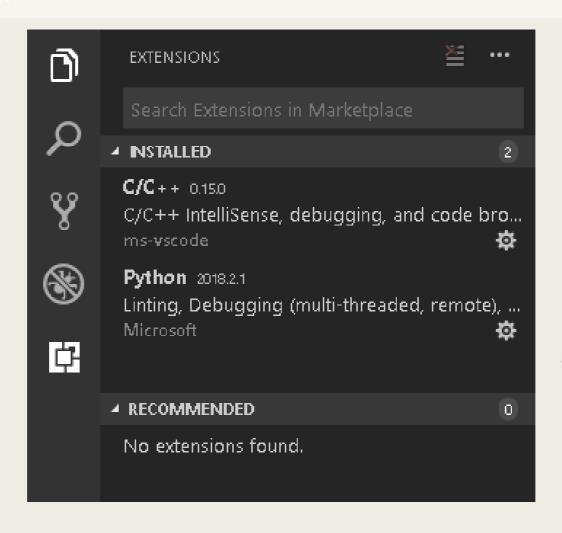




Install Extension



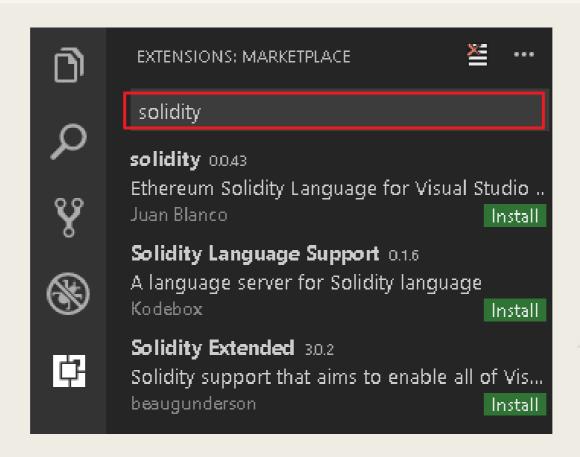




Search Extensions

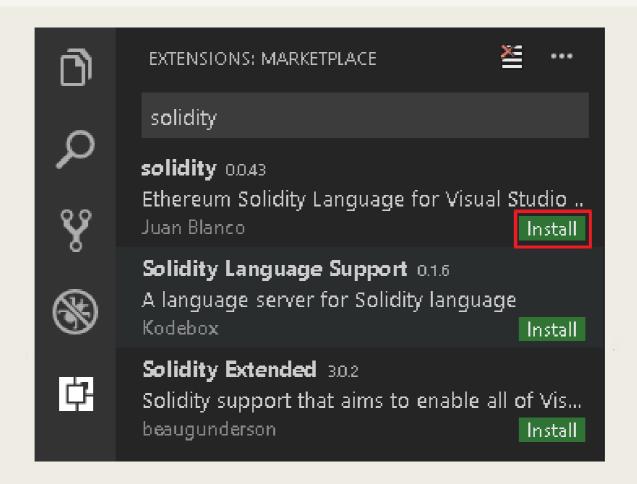






Search for the Solidity Extension

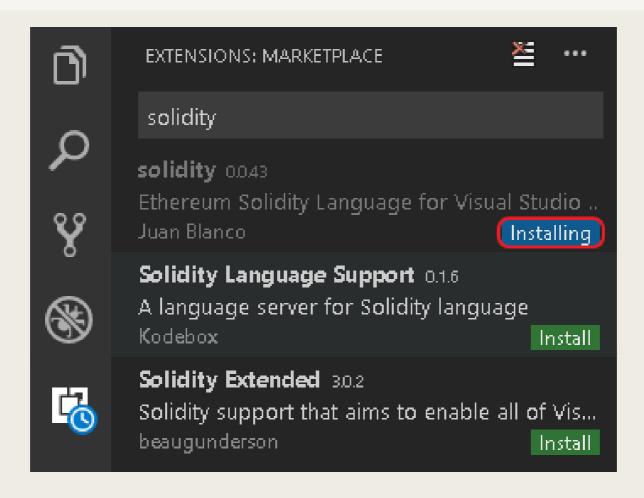




Install Extension



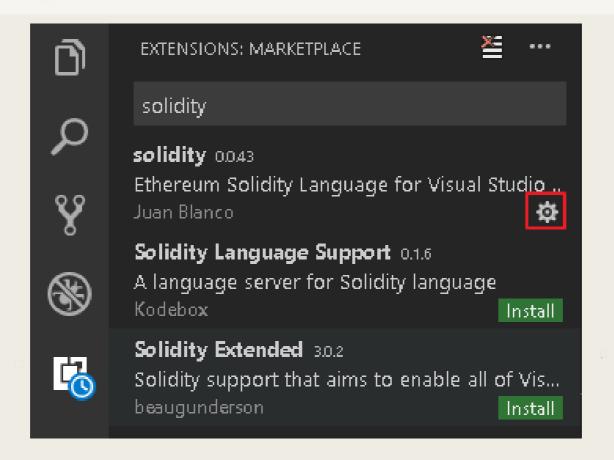




Installation in Progress



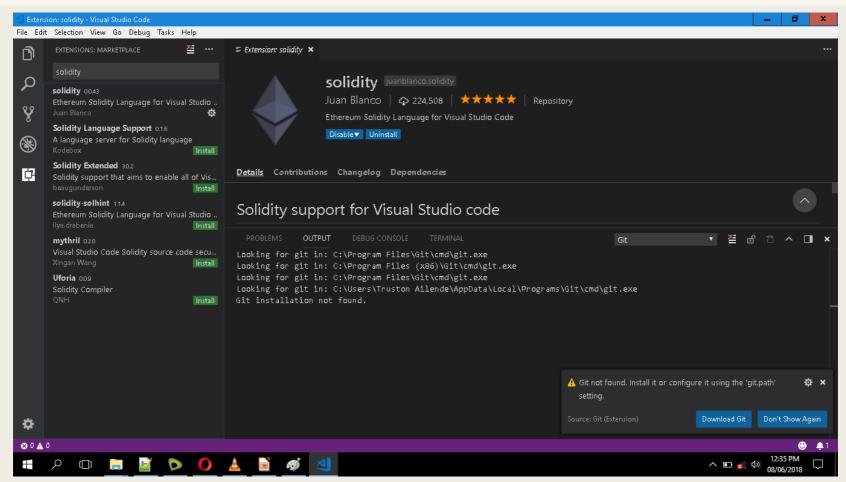




Installation Completed



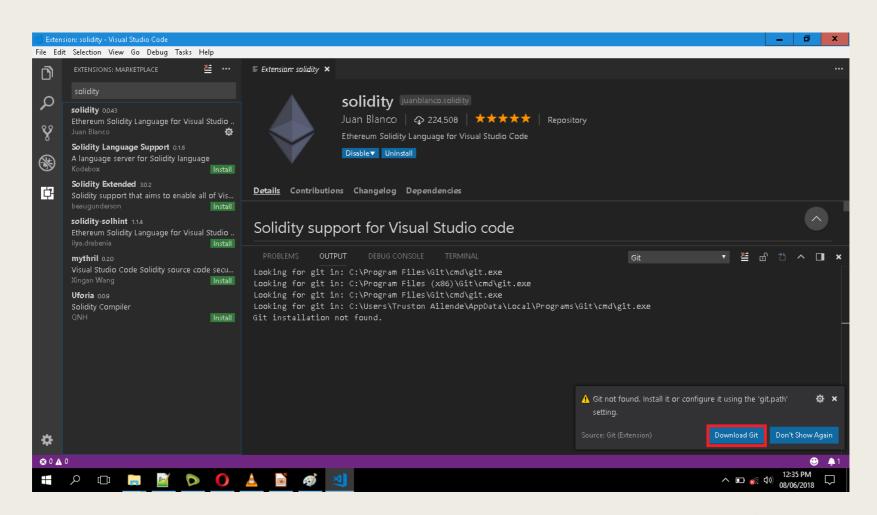




Current Screen











- Git is a version control system for tracking changes in computer files and coordinating work on those files among multiple people.
- It is primarily used for source code management in software development, but it can be used to keep track of changes in any set of files.



Downloads



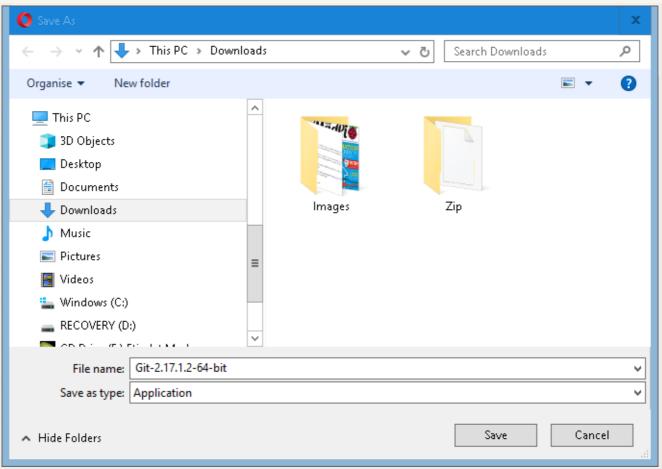
Older releases are available and the Git source repository is on GitHub.



https://git-scm.com/downloads



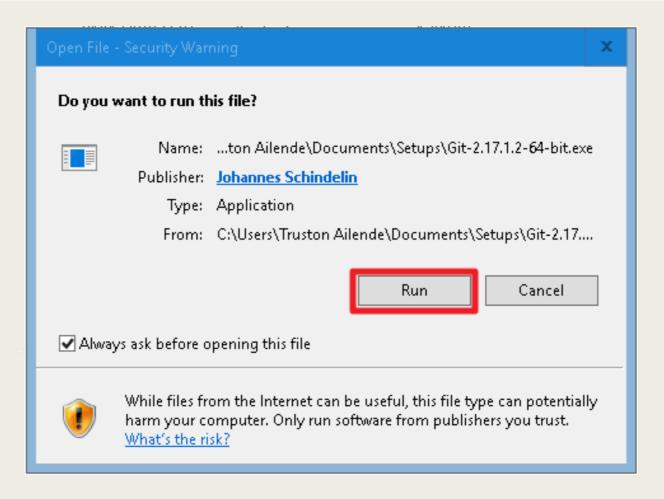




Popup Opens







Start the Installation







License Agreement





🐎 Git 2.17.1.2 Setup	_		х
Select Destination Location Where should Git be installed?			
Setup will install Git into the following folder.			
To continue, click Next. If you would like to select a different folde	r, click Bro	owse.	
C:\Program Files\Git	В	rowse	
At least 229.4 MB of free disk space is required. https://gitforwindows.org/ ————————————————————————————————————	ext >	Car	ncel

Select Destination Folder



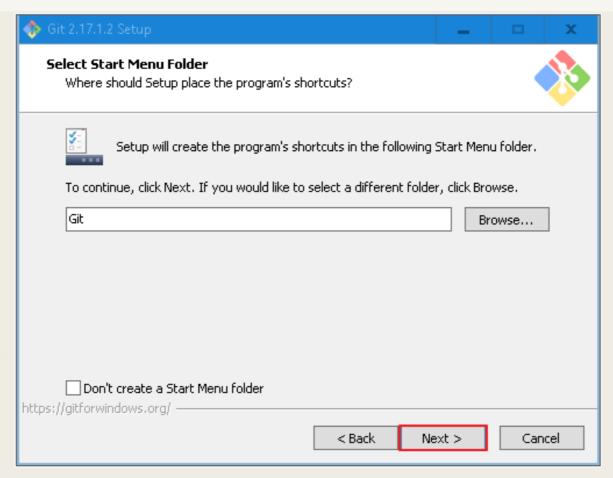


♦ Git 2.17.1.2 Setup	_		х
Select Components Which components should be installed?			
Select the components you want to install; clear the components y install. Click Next when you are ready to continue.	ou do not	want to	
Additional icons On the Desktop			
✓ Windows Explorer integration Git Bash Here Git GUI Here			
Git LFS (Large File Support) Associate .git* configuration files with the default text editor			
Associate .sh files to be run with Bash Use a TrueType font in all console windows			
Check daily for Git for Windows updates			
Current selection requires at least 229.0 MB of disk space. https://gitforwindows.org/			
	xt >	Car	ncel

Select Components



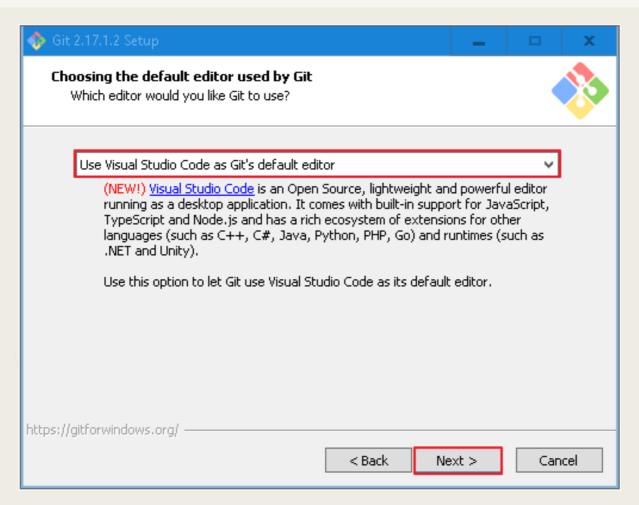




Start Menu Folder



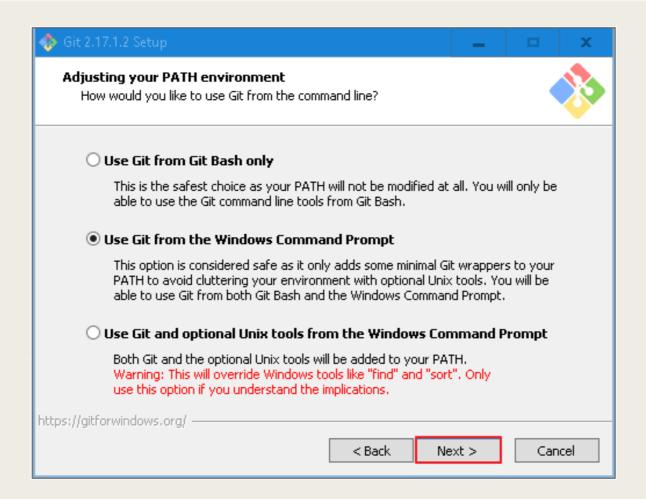




Choose Your Text Editor



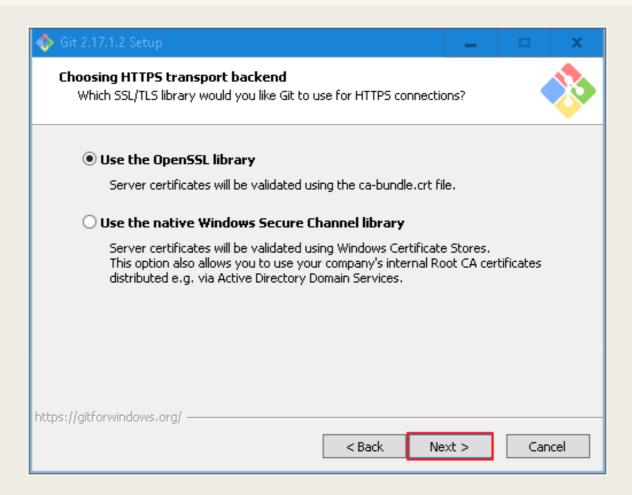




Adjust Your Path



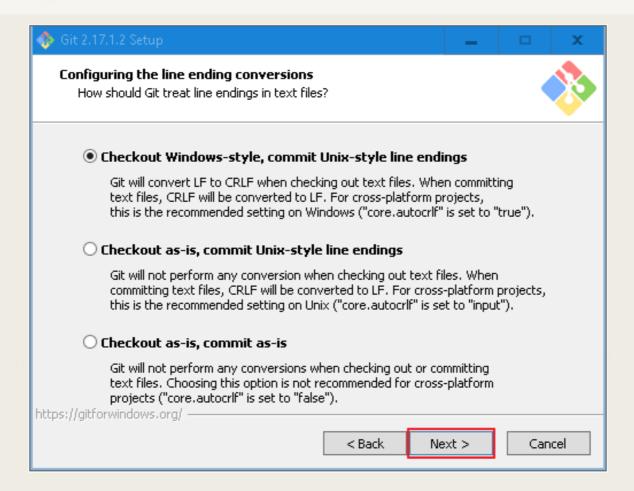




Use the OpenSSL Library



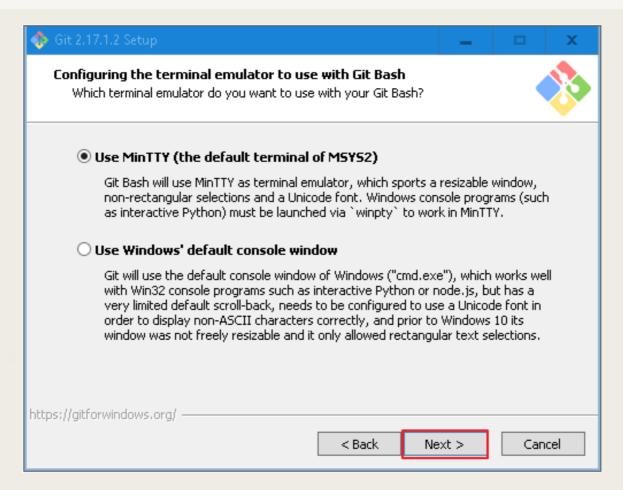




Configure Line Endings



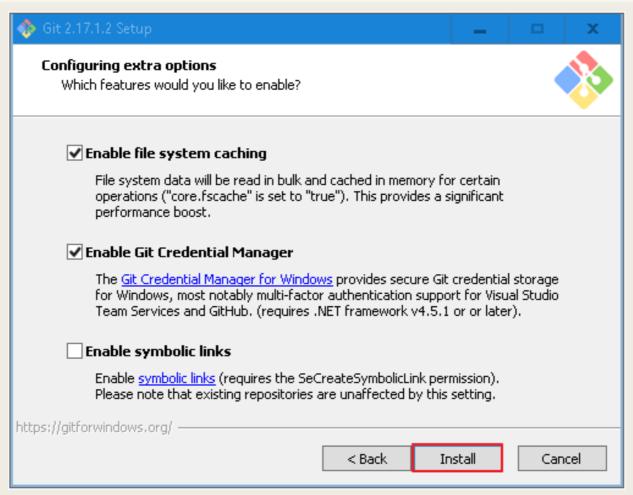




Configure Terminal







Configure Extra Options



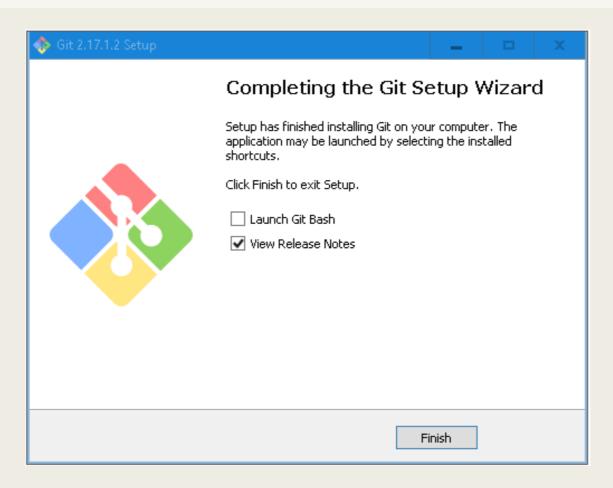


🐎 Git 2.17.1.2 Setup	-		х
Installing Please wait while Setup installs Git on your computer.			
Extracting files C:\Program Files\Git\mingw64\lib\tcl8.6\tzdata\Africa\Lubumbashi			
https://gitforwindows.org/ ————————————————————————————————————			
		Canc	el

Begin Installation







Installation Completed



We Are Ready



- Congratulations on having a working Windows setup for Solidity
- This process was long and tedious
- If we don't want to go through it, there is another way



Remix



- Remix is a powerful, open source tool that helps you write Solidity contracts straight from the browser.
- Written in Javascript, Remix supports both usage in the browser or locally.
- Remix also supports testing, debugging and deploying of smart contracts and much more.

Remix



```
M Correla 📝 Correla 📑 Log in 📗 RichDa | 🕏 Prover | 🕏 Busine | 🎁 How T | 🔟 How d | M Your k | M Inbox - | 🚉 Tired, l 👩 Your f | G remix: | 🕥 GitHuk | 🔢 Welco | 👲 Ret 🗶 🛨
                                                                                                                                                                                         \supset \bigcirc
                             remix.ethereum.org/#optimize=false&version=soljson-v0.4.24+commit.e67f0147.js
                                   * ± browser/ballot.sol *
                                                                                                                                        Compile
                                                                                                                                                             Settings Analysis Debugger Support
                                        pragma solidity ^0.4.0;
      browser
                                                                                                                                                ### Start to compile
                                     2 - contract Ballot {
      ▶ config
                                             struct Voter {
                                                 uint weight;
                                                                                                                                                                      Details Publish on Swarm
                                                bool voted;
Q
                                                 uint8 vote;
                                                address delegate;
                                                                                                                                              Static Analysis raised 2 warning(s) that require:

X
                                    10 -
                                            struct Proposal {
                                    11
                                                uint voteCount;
                                    12
ô
                                    13
                                                                                                                                              browser/ballot.sol:19:5: Warning: Defining constr

X
                                    14
                                             address chairperson;
                                    15
                                             mapping(address => Voter) voters;
                                                                                                                                                  function Ballot(uint8 _numProposals) public
                                   16
                                            Proposal[] proposals;
                                                                                                                                                  ^ (Relevant source part starts here and spans
                                   17
88
                                    18
                                             /// Create a new ballot with $(_numProposals) different proposals.
                                  19 →
                                             function Ballot(uint8 _numProposals) public {
                                   20
                                                chairperson = msg.sender;
\odot
                                    21
                                                voters[chairperson].weight = 1;
                                                proposals.length = _numProposals;
                                    23
Œ
                                    25
                                            /// Give $(toVoter) the right to vote on this ballot.
                                             /// May only be called by $(chairperson).
                                    27 +
                                             function giveRightToVote(address toVoter) public {
                                    28
                                                if (msg.sender != chairperson || voters[toVoter].voted) return;
                                    29
                                                voters[toVoter].weight = 1;
                                    30
                                    31
                                            [2] only remix transactions, script -
                                                                                       Q Search transactions
                                                                                                                         Listen on network
へ 幅 ...II (3)) 7:37 PM 08/06/2018
```

http://remix.ethereum.org/



MetaMask

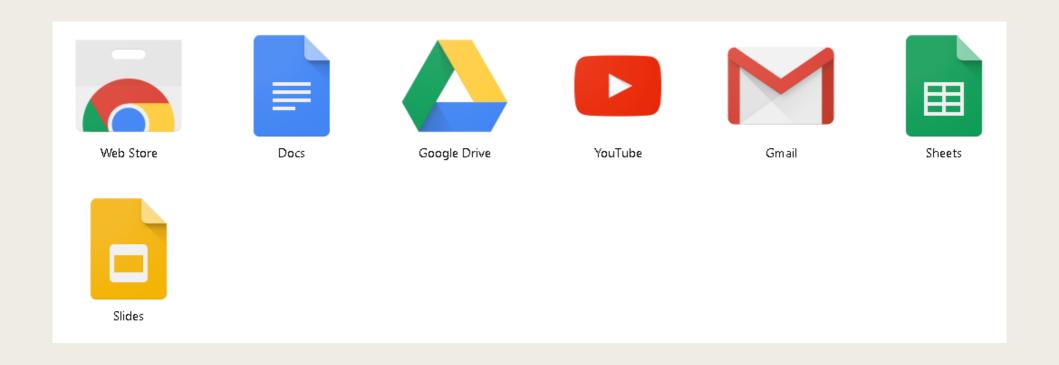


- MetaMask is an extension for accessing Ethereum enabled distributed applications, or "Dapps" in your normal Chrome browser!
- It allows you to run Ethereum dApps right in your browser without running a full Ethereum node



MetaMask



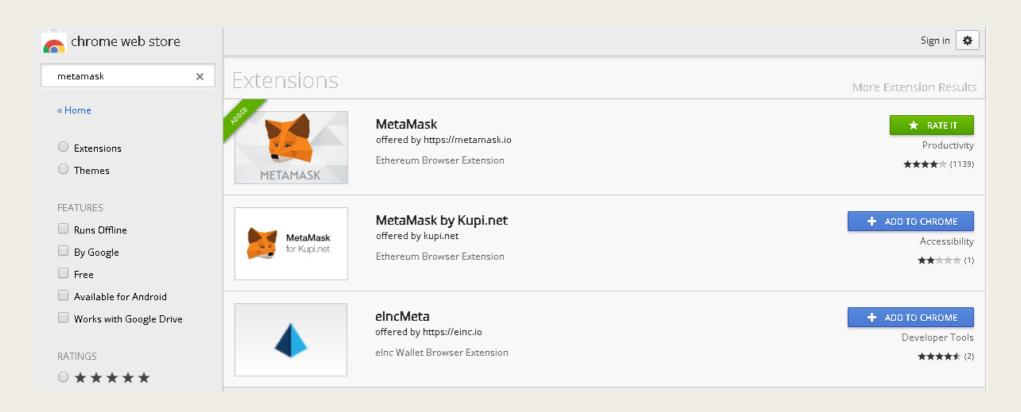


Visit the Chrome Web Store



MetaMask





Search and Add to Chrome



Conclusion



- At the end of this week, we have successfully configured our computer to run Solidity either in offline or online
- We shall take a look at Solidity programming in the coming weeks