Validation Guide

This work is supported by delegations to Notional's 35ish cosmos validators:

https://github.com/notional-labs/notional/tree/master/validation

Purpose

This guide is for the numerous individuals and groups that have contacted me in the past few months to try to learn the validation craft. I genuinely think that it is possible for anyone who is sufficiently motivated to validate from almost any place, very reliably.

By the end of this guide, you will have constructed a system that can fit in less than one cubic meter and satisfies the best practices that we at notional have discovered along the way. This means that your validator should exceed 99.9% uptime, have redundant Internet, and Require minimal service. This guide treats the validator as a closed system, which we will reduce in physical size and electrical consumption over the course of time.

History

Validating at home is how we started but that's not what we are today. Originally, at Notional we had about 85% uptime and we were based in a very small 2.6 m wide apartment in a wonderful neighborhood with great hamburgers.

Our organization now occupies a four-story office building but the server infrastructure is being purpose built so that it can fit in a closet. In fact if we followed our original designs, which were flawed, we could have as many as 20-50 validators on a single machine and it would be bad because a failure in that one machine could lead to a cascading failure of all of the validators on that machine.

We are designing fixed purpose validators that are about the size of a raspberry pi and have the necessary disk bandwidth to validate even an active chain like osmosis with confidence. It is my personal opinion that a full validation set up which includes machines for relaying and back up power has as well as Internet redundancy, should be able to fit in a closet, a small closet even, produced minimal noise, and be approximately as reliable as validating for the data center. But

this is not a natural state of affairs. Data centers have extreme redundancy with respect to electricity and internet.

This guide will not help you to get data center grade electricity, that is outside the scope of this guide. With that said, we recently purchased a very nice UPS system that uses lead acid batteries and will provide us with 2 to 4 hours of back up power. In our location, we never have more than about 15 minutes of electricity loss.

Electricity

You need 500w or so for two validators. Please note that modern CPUs use more and less electricity dependent on load and so what you want to do is exaggerate this number, you want to say that you want two kilowatts.

That box there is our back up power system. It cost $1000 and it can deliver two kilowatts for two hours. It has no cloud dependencies.

If your electricity goes out for longer than 15 minutes at a time, please get something larger. Our device is rated for 10 kVA and just like we have exaggerated our electrical load, we have also exaggerated how long we need to supply that load for, because we are attempting to build resilient systems here and you really don't want your power to go out. If your power goes out for long periods of time, you are either going to need a big big battery like the Tesla power wall or purchase a gas generator. You will need to make that call on your own, and I do want to warn you: I have personally worked with gas generators before and I absolutely hate them and that is why I don't own one. Not only can it poison you, it can also make your electrical systems less reliable.

Whenever possible I do recommend that you do your back up power from a battery. Again,for two hours of battery power, no matter what the load on your system is so if you have 500 watts of load, you want to look for a device that can deliver at least one kilowatt for two hours. There are many many types of these giant batteries, which are called uninterruptible power supplies and they are frankly not very expensive so, that is the section on electricity and here is a brief summary:

- If your electricity goes out for longer than 15m at a time consider a gas generator or very large battery.
  - Keep in mind that these devices can kill you and lower your overall reliability if they are installed incorrectly.
- Tesla power wall seems an attractive option
- Always over spec your electricity
  - We have 10x our current load, for 2 hours
- Your HVAC should not be on backup power
- Your Internet should be on backup power
- **Do not use any type of cloud connected uninterruptible power**

Tony "Abolish ICE" Arcieri 🦀🌹
@bascule

This seems bad... RCE and firmware authentication vulnerabilities in cloud-connected APC UPSes along with an alleged rare HCF attack armis.com/research/tlsto...

The fact that UPS devices regulate high voltage power, combined with their Internet connectivity— makes them a high-value cyber-physical target. In the television series Mr. Robot, bad actors cause an explosion using an APC UPS device. However, this is no longer a fictional attack. By exploiting these vulnerabilities in the lab, Armis researchers were able to remotely ignite a Smart-UPS device and make it literally go up in smoke.

Internet access

Our biggest financial mistake so far has been the purchase of three business grade Internet lines, which proved to be no better than residential grade lines, which we had the option of using but chose to get the fancy business grade lines. In our case, and I suspect in many areas and from many providers, there is no difference.

You want a reliable 100 Mbps and that should be able to service 20+ chains. At our lab we have three 500 Mbps lines. When they work correctly, we really only need one of them but they do not always work correctly and Vietnam has some undersea cable issues, and from a practical standpoint what that means is that we use a fancy router to prevent Internet downtime. Fancy does not mean expensive, however. Just go to Alibaba, and look for routers that have Intel CPU's and make sure that you get one that is compatible with open MPTCP router, and then the case of the ones with Intel CPU's, that's pretty much all of them.

We currently have installed:

- 4 4g dongles with year long unlimited data plans purchased with cash. The "with cash" part is a censorship avoidance mechanism.
- Three 500 Mb per second fiber optic lines, at a cost about $1000 per month each, however it is our teams universal observation that we could have purchased internet at 1/10th the cost. Don't over-spend.
  - When the subscriptions expire, we will change these lines to the residential version, because neither has a service level agreement, and both go down at the same time for the same reasons and seem to deliver the same bandwidth

We plan to install:

- Starlink
  - We have paid our deposit for a star link system and should receive it in the next year. This is especially attractive because it can consume back up power and even in the event of a grid failure, we will continue to sign

Internal network configuration

Unless you are incredibly confident about your Internet service provider, you will also want to have multiple connections. I usually advise people that they get as many different types of Internet as possible. You will then use openmptcprouter to bond the connections together.

- Intel atom router
- Openmptcprouter.org
- A vps with at least 1gbps

You can put OMR on the router using a USB stick.

After that, you will want to install a different OMR distribution on a VPS or bare metal server of your choice. It is generally my recommendation that people contact their local data center and

try to host there because that is only going to serve to aggregate the different Internet connections that you have. Currently, we have seven Internet connections and we aggregate all of them, if need be. In our case, this need only arises when there are problems with undersea cables.

Normally we are on one 500mbps line. This is best in terms of speed. If there are issues, the aggregator comes into play. While we have had difficulty with various aspects of our network operations, we have always been able to solve our problems with aggregation and the only reason that we recently moved offsite was the Covid virus. We are currently moving all of our systems back to our site in Hanoi.

Network summary

- A single fast 4g dongle is sufficient for validation of a single chain
- Fiber is best
- Cable and adsl ought to be fine, too

Computing hardware

This is the spec of Notional's osmosis validator. It has consistently been the fastest validator on the osmosis network.

STT	Loại hàng		SN	Đơn giá (VNĐ)	Số lượng (Chiếc)	Thành tiền (VNĐ)	Tình trạng/Bảo hành
BẢNG BÁO GIÁ						
1	CPU	CPU Intel Core i5-12600K (3.7GHz turbo up to 4.9Ghz, 10 nhân 16 luồng, 20MB Cache, 125W)		7.600.000	1	7.600.000	NEW/ 36 THÁNG
2	RAM	RAM Samsung 64GB (32GBx2) DDR4 3200 Mhz		3.500.000	2	7.000.000	NEW/ 36 THÁNG
3	Main	Mainboard ASROCK Z690M-ITX/ax (DDR4)		6.800.000	1	6.800.000	NEW/ 36 THÁNG
4	SSD	SSD Samsung 980 PRO 2TB PCIe NVMe 4.0x4 (Read 7000MB/s - Write 5000MB/s)		8.300.000	1	8.300.000	NEW/ 36 THÁNG
5	Nguồn	Nguồn FSP Power Supply FlexGURU Series Model FSP250-50FGBBI Active PFC 80 Plus /Flex ATX		1.200.000	1	1.200.000	NEW/ 36 THÁNG
7	CASE	Case Izmod A24		2.000.000	1	2.000.000	NEW/ 12 THÁNG
						32.900.000	

The configuration above has worked out so well that I recommend you just copy it. I don't recommend any modifications to this, except possibly to use a faster disk, with the stern warning that in our experience these Samsung drives are very reliable. None of our Samsung drives have failed. The CPU above is nvme 5.0 compatible but as of now no nvme 5.0 drives have come to market.

We have had failures with seagate and western digital nvme drives.

We will soon test an Intel P5800x.

NB: the 1.6tb Intel P5800x cost us just shy of $5000 and I do not recommend using one in "my first validator". You can run an osmosis validator with no issues on just about any pcie 4.0 or 5.0 four lane nvme drive.

You do not need to use an anti static bracelet when building the validator.

Cost

Because of regional price differences, cost is almost certain to vary, but in order to get started with a reliable setup, here is the cost breakdown, with hardware tailored to Osmosis.

One time costs:
- $1000 - computer
- $1000 - backup power
- $200 - Intel atom openmptcp router
- $200 - four 4g dongles

Monthly costs:
- $200 - internet: four 4g dongles
- $200 - internet: fiber
- $100 - hosting: aggregation

All told this amounts to about $2900.

Please note that scaling this across additional chains is less expensive than the initial setup. I recommend one separate computer per chain.

Income

Validator income can be calculated like:

(total inflation distributed to validators daily)*(votepower)*(commission) = daily income

Your mileage will vary by:
- Price of coin
- VotePower
- Inflation parameters

Software

I recommend anarchy Linux, which is an arch distribution that has an installer. I find it to be extremely reliable.

I do not recommend using Ubuntu, it does not ship up-to-date software packages. If you use ubuntu, you will very likely have problems with out of date software and I will be both unable and unwilling to help.

After installing anarchy Linux, bringing your system up is relatively simple. Make sure that you choose the server installation, because you will not Need a graphical user interface on your validator. In the notional-labs/notional repository, we have a standup script that works with arch and installs all of the software that you might need to run and monitor your validator. It is in the infrastructure folder and it's called standup.bash.

OK so if you have gotten this far, you have a fast and reliable computer, reliable electricity, and multiple Internet lines.

You are ready to replace Osmo team red.

02:59

🔒 ping.pub

🔍 🇺🇸 ⚭ Wallet

☐ 101 nonce classic

☐ 102 Ledger by Figment

☐ 103 ITA Stakers

☐ 104 Hathor Node

☐ 105 Earth+

☐ 106 Analytic Dynamix

☐ 107 StarCluster

☐ 108 天照☀️

☐ 109 Mandragora

☐ 110 Astra.Voyage

☐ 111 Plural

☐ 112 FreshOSMO.com

☐ 113 stake.systems

See the red ones? You will replace them. Yesterday, March 5, 53 osmosis validators did not complete the epoch block on the schedule.
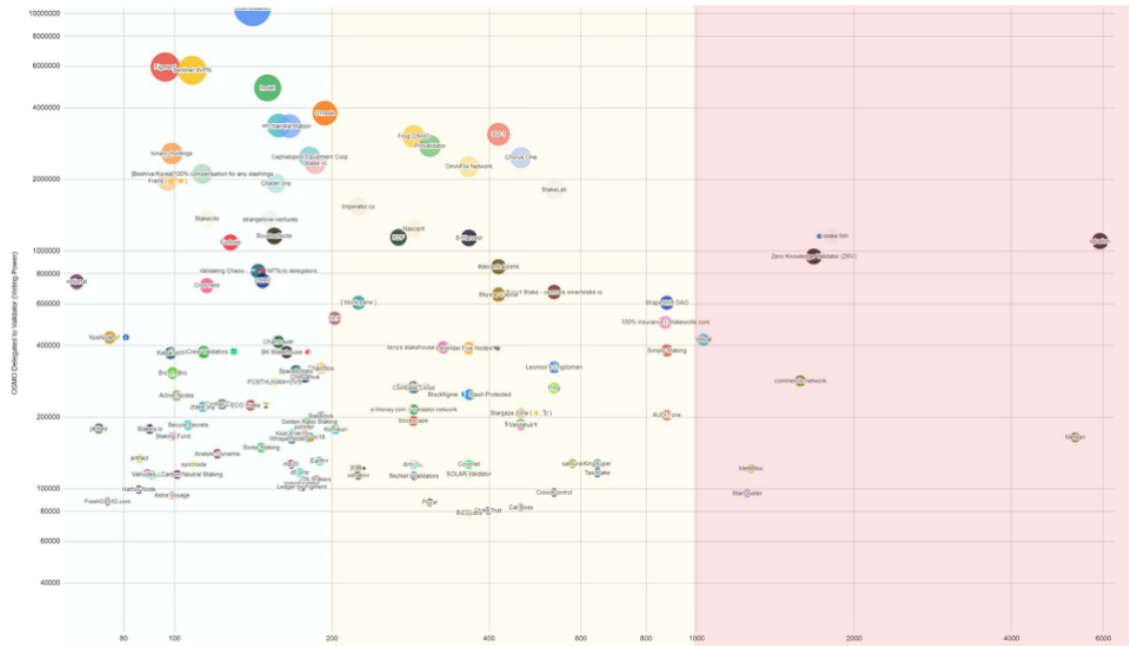
delegators can reduce epoch time to less than 200 seconds by delegating only to validators in the left-hand white colored region.

I do not think that it will prove to be terribly difficult for you to offer better services and join the active set.

Sentries

Most of the time Notional does not use sentry node architecture. In general, I do not recommend that others use it either. However, it is not super harmful. What it does is it adds a single hop of latency between you and other places and it also makes your validator reliant on the uptime of additional machines that you do not have the same level of control over. You should choose whether or not you would like to use sentries, and I want to note that in my experience sentries create additional risk, add costs, and increase the complexity of a validating system with little clear benefit.

When your validator isn't on a network that you personally built, under your total control, it may make sense to use sentries. Some blockchain teams also specifically request the use of sentries and our policy at notional is to defer to blockchain dev teams provided that they do not wish to take actions that can harm end users.

It is, for example, possible to configure your node so that it only makes outgoing connections, or use proxies to redirect its traffic. We have done both at Notional and run validators like this:

- 100 outbound p2p connections
- Private peers with other validators over a software network

You will lose all of the performance benefits of your validator if your sentry nodes are slower than your validator. Equal spec sentries add very little delay to time sensitive events like osmosis daily epoch. Lower spec sentries will slow down your validator, and this is specifically a cause of difficulty for the majority of osmo team red. They are running slow sentry nodes.

Secrets

Each validator has exactly two secrets that you must not lose:

- priv_validator_key.json for infrastructure
  - Validators sign blocks with this key
- seed phrase for chain transactions
  - The seed phrase is an entropic seed that can be used to create limitless addresses. It is used to generate a private key, which yields a public key, which yields an address

You must protect both of these. The key file can be backed up onto an encrypted USB device. The seed phrase should be handled per your personal preferences.

priv_validator_key.json == block signatures
seed phrase == signing tx to interact with the chain like sending money

Ethics

As a Validator, pretty much the only time that you **must not** be transparent with your delegators and the wider user community is when there is a security problem with the chain. When there is a security problem, you should only speak with the developers about that.

At all other times, I recommend that you practice radical transparency and accountability, meaning that if you experience a failure in any of your systems, you announce that failure to the community and describe its mitigation. This is a practice that has enabled Notional to improve

rapidly because it forces us to communicate with users and consider how to ensure that issues do not re-occur.

If you screw up, just say so.