VMware Home Labs:
A Definitive Guide 2020 Update

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Purpose of the Home Labs: A Definitive Guide

Over the years common themes and questions came up around Home Labs…

- *Where do I start?*
- *Why should I build a Home Lab?*
- *What are some of your experiences with Home Labs?*
- *Do you have any examples of Home Labs?*
- *What should I consider when building a Home Lab?*

If you think about it, Home Labs are like porridge…

The Goldilocks Principal

Agenda

- **Consider the following about Home Labs**
  - What is a home lab?
  - Why build a home lab?
- **Planning your Home Lab**
  - Where do I start?
  - Software Requirements Table
  - Considerations Table
  - Planning Example
- **Building up your Home Lab**
  - The Fantastic 4
    - Hosts, Network, Storage, Licensing
- **Recommendations**
- **My Current Home Lab**
- **Helpful Links**

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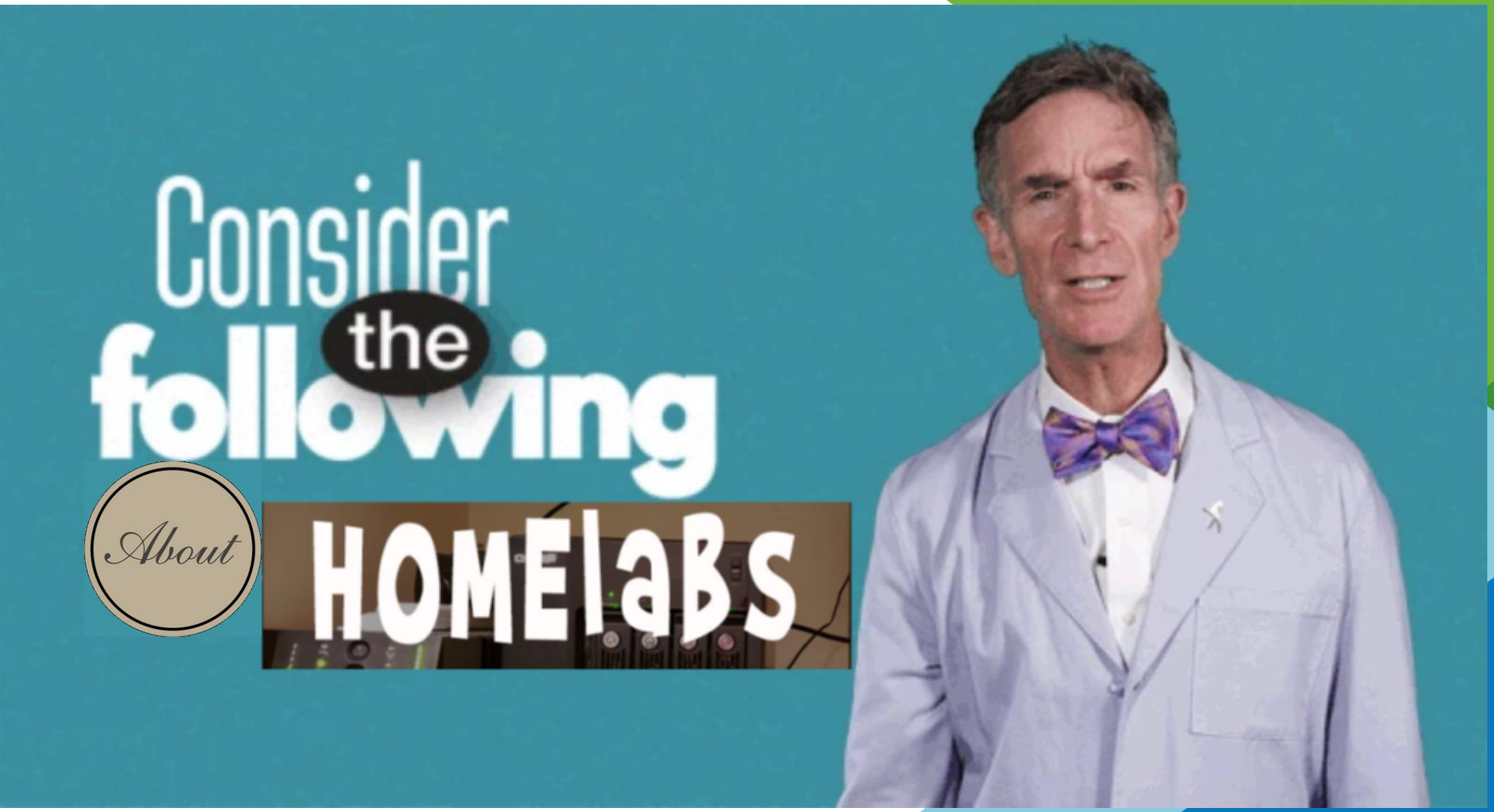

Consider
the
following
About
HOMElaBS

What is Home Lab?

- There are many different types for Home Labs, but for this presentation: a home lab is any type of non-production VMware environment meant for personal or development use.
- Depending on your expected outcomes and budget it may contain different, outdated, and dislike hardware (or it may not) OR it could contain connections to cloud resources.
- VMware Home Labs usually run the following software:
  - VMware Workstation (Nested Environment)
  - VMware vSphere Environment (vCenter Server, ESXi, vSAN, etc.)

Why build Home lab?

Hardware

Software

Certification Prep

Career Advancement

Confirm a fix

Do something different

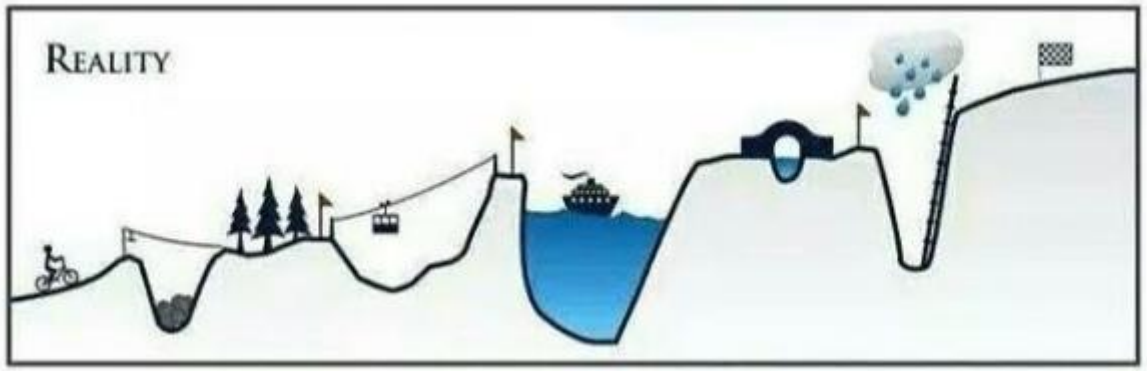
Emerging Tech

Test a Theory

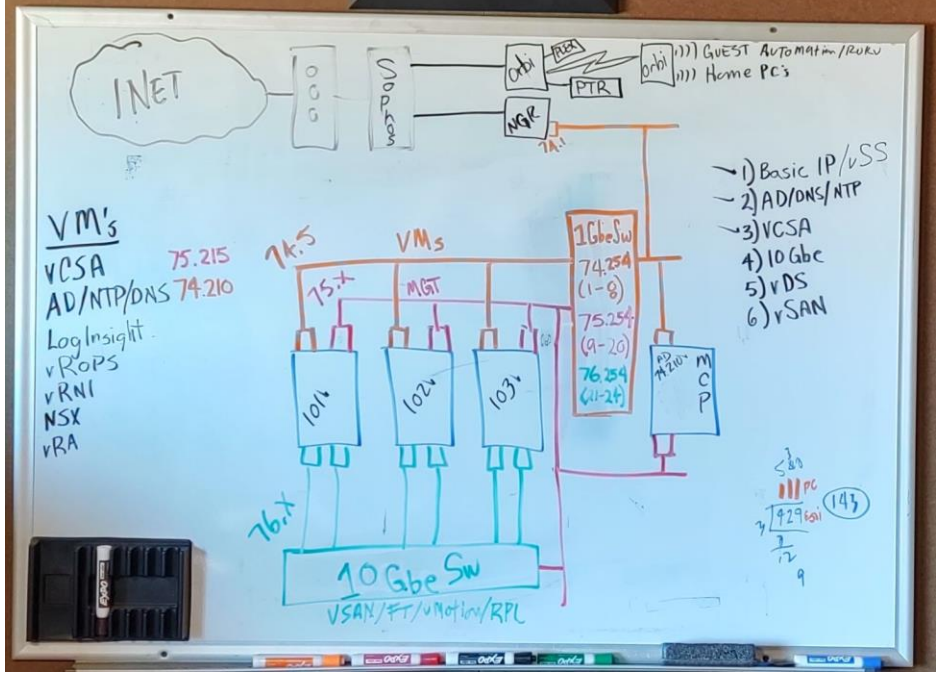
Planning your Home Lab

Where do I start?

- Have a plan and run your Home Lab same as a production environment
  - Hardware, Networking, Power, Cooling, Installations, Documentation
- Start out small and build it up, but have a plan



Where do I start? (Resist buying first)



- **Think about the requirements and outcomes?**
  - What do you want to do with your home lab?
  - Will it involve your personal home network?
  - Do you like the hardware or software side of Home labs, maybe both?
  - Ask questions, talk with others, gather information
- **Form your ideas**
  - Whiteboard or document your ideas / requirements
- **Research the software requirements (See Table)**
  - What are the software requirements | Do you need training or hands on experience?
- **Review the Home Lab Considerations Table (See Table)**
- **Research what hardware you may need**
- **Lastly, (in my opinion) if you can explain your home lab simply, your ready…**

Research the software requirements (08/2020 Update)

Product	CPU	RAM	Disk	LINK
VMware vCenter Server 7.x Standard (VCSA)	vCPU 2 TNY / 4 SML 8 MED / 16 LGR	12GB TNY / 19GB SML 28GB MED / 37GB LRG	415GB to 3.6TB	Recommended Link
ESXi 7.0 Hardware Requirements	2 pCORES MIN	4 GB MIN + 8GB for VM's	Varies 8GB-32GB	Recommended Link
VMware NSX-T 3.0	NSX Manager 2-12 vCPU NSX VM Edge 2-16 vCPU	NSX Manager 8GB-48GB NSX Edge 4-64GB	NSX Manager 300GB (<10ms) NSX Edge 200GB	NSX-T Link
VMware vRealize Network Insight 5.3	10-20 vCPU	32-64GB RAM	1TB-2TB	Recommended Link
VMware vSAN™ 7.0	ESXi Host standard 4 pCORES Recommended	32GB MIN RAM Link	All FLASH 2 x SSD Hybrid 1 SSD X 1 HDD	Recommended Link
VMware Site Recovery Manager 8.3	2-4 pCORES	4GB MIN	5GB MIN	Recommended Link
VMware vRealize Log Insight™ 8.1	4 vCPU	8GB	530GB	Recommended Link
VMware vRealize Operations™ 8.1	2-24 vCPU Remote Collector 2-4 vCPU	8GB-128GB RD: 4GB-32GB	Use Worksheet in Recommended Link	Recommended Link
VMware vRealize Automation 8.1	12 vCPU	40GB	250GB	Recommended Link
VMware vRealize Orchestrator 8.1	4 vCPU	12GB	200GB	Recommended Link
VMware vCloud Suite® Standard	NA	NA	NA	Recommended Link
VMware Horizon® Advanced Edition 7	NA	NA	NA	Recommended Link

Review the Home Lab Considerations (2020 Update)

Design Considerations	Description
Initial Cost	How much does the Home lab solution cost to build out
Noise	When the home lab is running how much noise will it produce and are the noise levels appropriate for your use case.
Heat / Power Consumption	Does the home lab produce to much heat for the intended location
Monthly Operational Cost	Based on cost for electricity in your area, how much is it going to cost to run?
Footprint and Mobility	How much space does the solution take up and how mobile is the solution?
Flexibility	Based on the type of product you choose, how flexible is the solution when hardware or other changes are needed to expand.
Bleeding Edge VMware products	How does the solution align to emerging products without major overhaul
VMware HCL Support	How does the on-prem solution to the Hardware combability guides
Refresh Cost (Reusability)	Financially, what would it take to refresh, replace, or update the hardware solution Consider how adaptable is the solution to changing hardware and software demands.
Speed to Use	How quick can the hardware solution be deployed and is useful

Example of Planning out a Home lab

- Most recently I updated my home lab from Generation 4 to Generation 5.
- I document all my home lab Generations on my blog and how I migrate them.
- For Generation 5, I created 6 videos around my findings and outcomes
- Here are the steps I review when updating or rebuilding my Home Lab.
- **First:** What are my initial use cases and goals
- **Second:** Evaluate Software, Hardware, and VM requirements
- **Third:** Review / Document the Home Lab Design Considerations Table
- **Fourth:** Choose the hardware
- **Fifth:** Finalize my orders and start the assembly process
- **Finally,** learn from my mistakes ☺

- Pro-Tip: use Google Sheets

Building up your Home Lab

The Fantastic 4 – around Home Labs


ESXi
Hosts

Common types of ESXi - Building blocks

Laptop

Workstation and DIY PCs

NUC and Micro-Servers

Enterprise Server Class

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Classification of Building blocks for comparison

1. **Nested Workstation**
   - Run VMware Workstation or VMware Fusion for Windows, MAC, or Linux
   - PC, Laptop, or Workstation class computer
   - One CPU, lots of RAM, multiple disk drive slots, and NICs.
2. **Mobile / Compact Cluster**
   - Run ESXi
   - 2-3 NUCs, MAC MINI, or Micro-servers
   - One CPU, lots of RAM, 1-2 Disk slots, NVMe slots, Thunderbolt, external power supply
3. **Business Workstation / White box Cluster**
   - Run ESXi
   - 2-3 or more PC or Workstation class computers
   - 1-2 CPUs, lots of RAM, multiple disk drive slots, lots of room for expansion
4. **Server Class Cluster**
   - Run ESXi
   - Consists of 3 or more server class computers,
   - 1-4 CPUs, lots of RAM, multiple disk drive slots, lots of room for expansion

How do these Building blocks compare?

Design Considerations	Nested Workstation	Mobile Compact Cluster	Business Workstation Cluster	White box Cluster	Server Class Cluster
Initial Cost	$1,200	$3,000	$3,000	$3,000	$1500-3000
Noise	Low	Low	Can be Low	Can be Low	Loud
Heat / Power Consumption	Low (~125 Watts)	Med (~200 Watts)	Med-High (300-600 Watts)	Med-High (300-600 Watts)	High (~800-1K Watts)
Monthly Operational Cost	Low $11/mo.	Med $17/mo.	Med $28/mo.	Med $28/mo.	High $70/mo.
Footprint and Mobility	Depends (Laptop, NUC, PC)	Very Small Very Mobile	Large Footprint Not Very Mobile	Large Footprint Not Very Mobile	Large Footprint Not Very Mobile
Flexibility	Somewhat	3 x NUC Small Limited Flexibility	3 x Workstations Flexible	3 x Desktops Very Flexible	3 x 1U or 2U Somewhat Flexible
Bleeding Edge VMware products	Yes (Limited by Nesting)	Yes (Limited by Flexibility)	Yes (Very Flexible)	Yes (Very Flexible)	Yes (Very Flexible)
VMware HCL Support	No	No / Limited	No / Limited	No / Limited	Possible
Refresh Cost (Reusability)	Low	Buy New / Some Adds	Buy New / Some Adds	Change out components	Buy New / Some Adds
Speed to Use	Quick	NUCs - Quick Micro Servers – Quick	Quick	Not as Quick	Quick

ESXi Hosts – Building Blocks example…
From PC > Nested Workstation > White box Cluster

- One strategy around building up your home lab is to start with what you have and build up from there.
- As you evolve you home lab think about choosing items that you repurpose
- Example I had the same case for 17 years.

2003

2020

ESXi Host Trends for 2020

- CPU's
  - 4 Core CPU's are struggling to keep up with software demands
  - Hyperthreading is a dying technology and should not be considered cores
  - Used E5 Xeon (v2-v4) CPU's have fallen in price ($20-$80) | Don't forget about AMD CPUs (Great Value)
- System Boards
  - X79 / X99 System boards with single or dual Socket 2011 have fallen in price
  - New or Used System Boards ($85-$140) | Lookout for Narrow 2011 & Special Power Requirements
- RAM is in high demand
  - Shoot for 128GB systems or better
  - Used DDR3/DDR4 ECC prices dropped (128GB, $100-$200)
- HBAs
  - Have been hearing about Enterprise Servers not accepting all HBA's
- Laptops
  - Modern performance-based Laptops are starting to be a good approach for Nested Home labs. Ensure lots of Cores, RAM, SSD, and/or NVMe disks. Avoid Spinning Disks = poor performance

Networking

What are the common types of networking?

L3 Switch, VLAN, Managed, PoE, NetFlow

1 Gbe and/or 10 Gbe SFP+ / DAC Cables

Ethernet Cross over cable

InfiniBand Switch 10Gbs – 100Gbs

Subnet Manager

InfiniBand

Cable

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Networking Trends for 2020

- Low Latency Networks (RDMA) are starting to trend for vSAN (Do your research)
- 10Gbe per port price is stable but starting to fall a bit, look for switches that have 10Gbe SFP+ and use DAC cables
- If you are looking for “cheap” but new 10Gbe switch, consider MikroTik
  - Fair Warning – their CLI can be hard to learn, its not intuitive or Cisco like in anyway.

CRS309-1G-8S+IN

Desktop switch with one Gigabit Ethernet port and eight SFP+ 10Gbps ports

CRS305-1G-4S+IN

Five-port desktop switch with one Gigabit Ethernet port and four SFP+ 10Gbps ports

*

Storage

What are the common types of shared storage?

openfiler

FreeNAS™

&

TrueNAS®

Storage Arrays

Personal or SMB

Powered By vmware vSAN™

HCI

VMware vSAN

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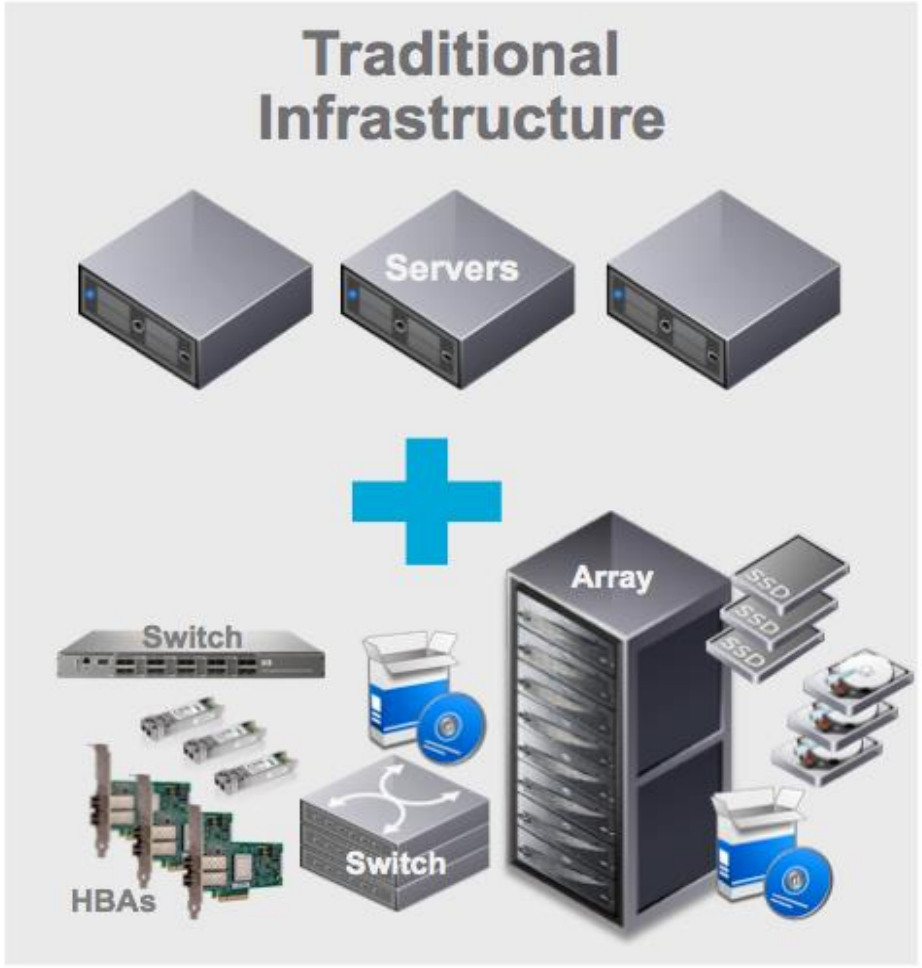
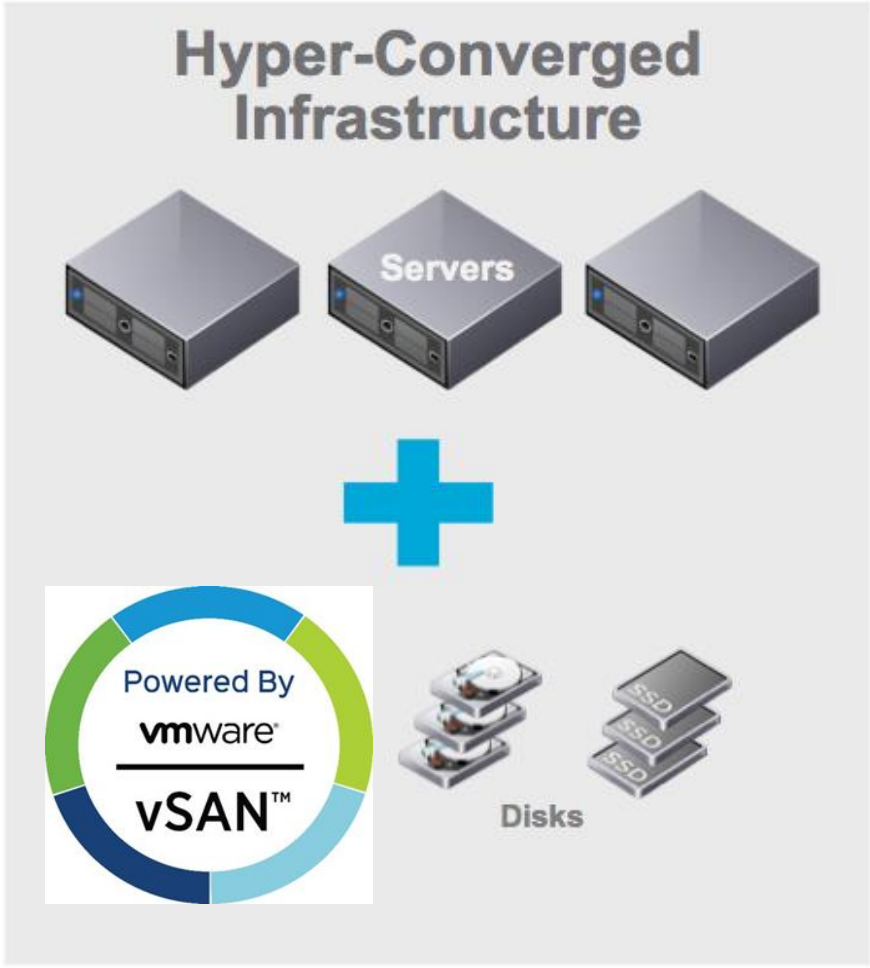
Consider the following around Storage….





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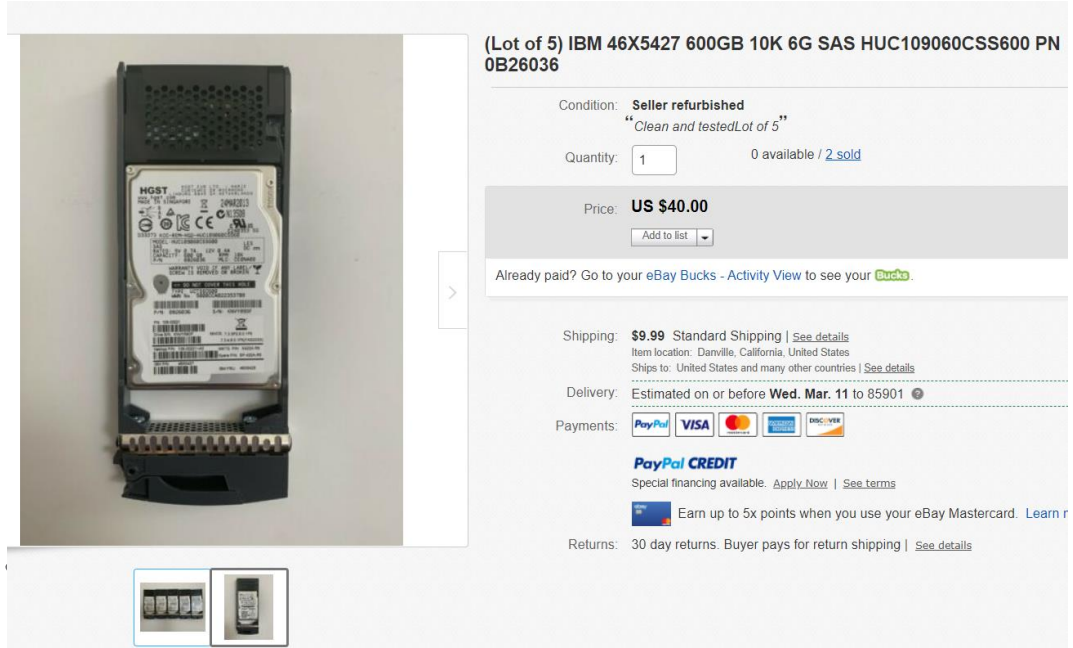
Trends in Storage for 2020

- Used Enterprise SAS HDD, Flash, and NVMe are all dropping in price
- The used market is flooded with cheap Enterprise SAS drives from Storage Arrays
- Look out for:
  - NetApp Drives can come with 520b Sector size vs. a 512b Sector size
  - These disks can be labeled as IBM, Hitachi, Seagate, etc. Best to check with the seller if the drive you are interested in was used in a NetApp Array.
  - Some have been successful using these disks, but my recommendations is to avoid as most SAS Controllers will have issues




Licensing
Shift

Consider this for Licensing…

VM's

Visual Studio

Linux

Hosts

Servers

Motherboards

IPMI / Remote Access

Networking

Switches might need licensed to enable features (InfiniBand this is a must)

Storage

Storage Arrays and even HCI might need license to enable features

What about VMware Licensing?

- Your company may have keys. Check your licensing agreements
- Work with your VMware Account team / TAM, they may have options
- If you are a VMware Partner, consider NFR Keys (request additional)

vmware® PARTNER NETWORK

Consider VMUG Advantage (Eval-Experience) $200/yr

Exclusive Licenses

VMUG Advantage provides members exclusive development opportunities with 365-day access to VMware solutions, discounted training, certification opportunities and more.

Data Center & Cloud Infrastructure

- VMware vCenter Server Standard (includes vRealize Suite 2019 Enterprise and vSphere Enterprise Plus)
- VMware vSphere® vCloud Suite Standard
- **VMware vSphere® 7 *NEW**
- VMware Cloud Foundation

Networking & Security

- VMware NSX Data Center Evaluation
- VMware vRealize Network Insight

Storage and Availability

- **VMware vSAN™ 7 *NEW**
- VMware Site Recovery Manager

Cloud Management

- VMware vRealize Orchestrator
- VMware vCloud Suite® Standard

Desktop & Application Virtualization

- VMware Horizon® Advanced Edition
- VMware vRealize Operations for Horizon®

Personal Desktop

- VMware Fusion Pro
- VMware Workstation Pro

Become a VMware vExpert

- License keys are one of the program perks
- Need help reach out to a follow vExpert

Name
2020 - Fusion 11
2020 - Horizon Enterprise 7
2020 - Integrated OpenStack 6.0 - Data Center
2020 - SRM 8 ENT
2020 - vCenter Server 6 Essentials
2020 - vCenter Server 6 Standard
2020 - VMware WorkStation 15 Pro
2020 - vRealize Code Stream 2
2020 - vRealize Log Insight 4
2020 - vRealize Network Insight Enterprise
2020 - vRealize Suite 2019 Enterprise Edition
2020 - vSAN 6 Enterprise
2020 - vSphere 6 Enterprise Plus

Recommendations

For starting your Home Lab

Quick note: Recommendations below are just that… recommendations
Your system, your design, and your plan may vary

Start with VMware Workstation

- Recommendation:
  - Draw up a plan of what you want to accomplish
  - Install Workstation on to your laptop or PC and get familiar with setting up a nested environment. Most VMware products can be installed
  - This is not time wasted as the VM's can be moved to ESXi hosts
  - Think about "building blocks". What next for your home lab?
- Workstation Hardware:
  - PC, MAC, Laptop, NUC, workstation class PC (Check the VMware Workstation requirements)
  - Lots of RAM (32GB or better)
  - 1Gbe pNIC or two
  - 6 Core or better CPU
  - FAST disk access – SSD, M.2, NVMe
  - Multiple smaller HDDs (Distribute your VMs)
- PROS: Cost effective way to start your Home Lab, carry over into your next generation Home lab
- CONS: No support for VLAN or external routing, at some point performance might be a factor

Building an ESXi Home Lab

- Recommendation:
  - Enhance or draw up a plan, have good idea of what you want to do with your Home Lab and how it might grow. Think how am I going to expand my home lab?
  - Go with VMUG Advantage / Visual Studio for your Licenses.
  - Use what you have but use as many common “building blocks” (Mobos, pNICs, Disk, RAM, CPU)
  - Don’t forget about Networking, DNS, TCP/IP, DHCP
  - Use your VMware Workstation PC to house some services
- Hardware:
  - 2-3 x ESXi Hosts, Layer3 Switch + 10Gbe SPF+ ports, vSAN or OpenFiler/FreeNAS
  - ESXi Hosts
    - Case: ATX/EATX case, lots of drive bays, easy to working on, fits cheap commodity parts
    - Mobos: Look for 64GB or better, support for ECC/Non-ECC RAM, CPU Support, 8x or better PCIe ports , Use the 16x PCIe < ensure you can, Headless (look for AST2400), NVMe/M.2 support
    - SSD: SAS Based better, Standard SSD okay
    - HDD: Have at least one host with a large HDD, comes in handy for moving VM’s around
    - Boot to USB or flash SD
    - Power supply: Look for efficient as possible
- PROS: Longevity, Cost Control, max flexibility, Low Noise / Heat
- CONS: Overall Size can be a bit bulky for some designs

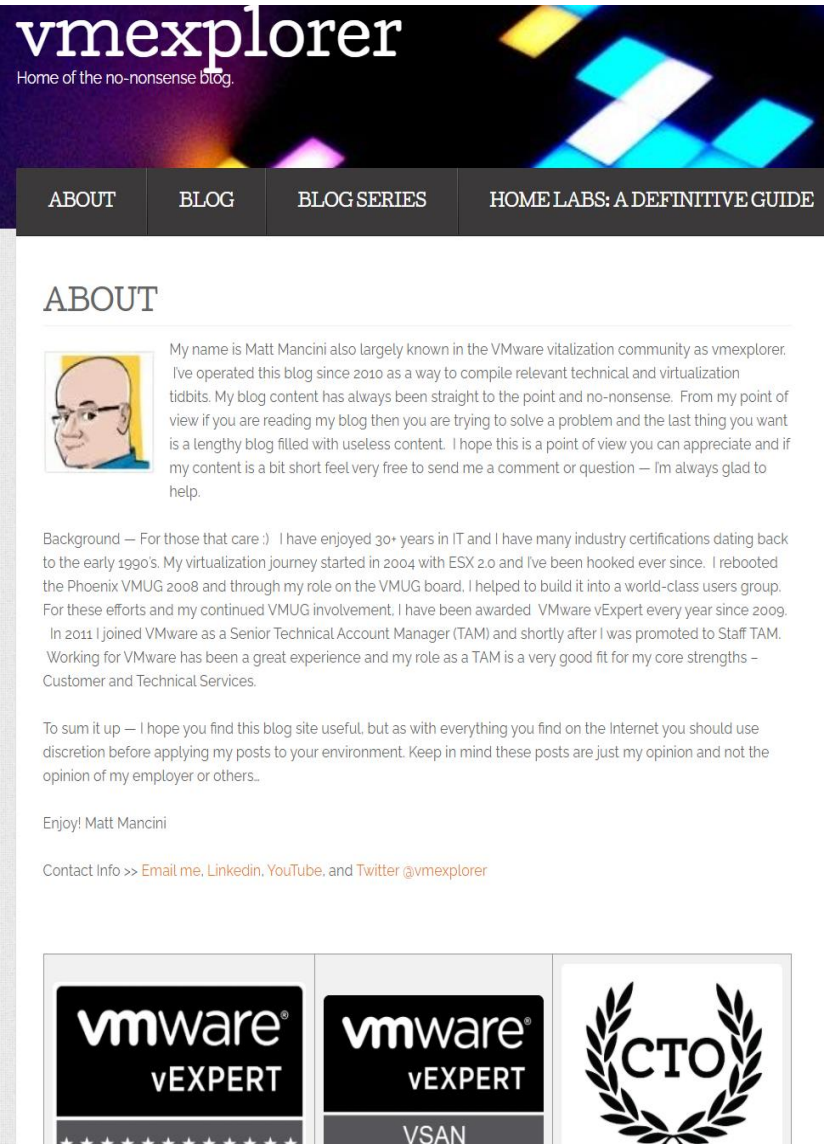
My Home Lab for 2020

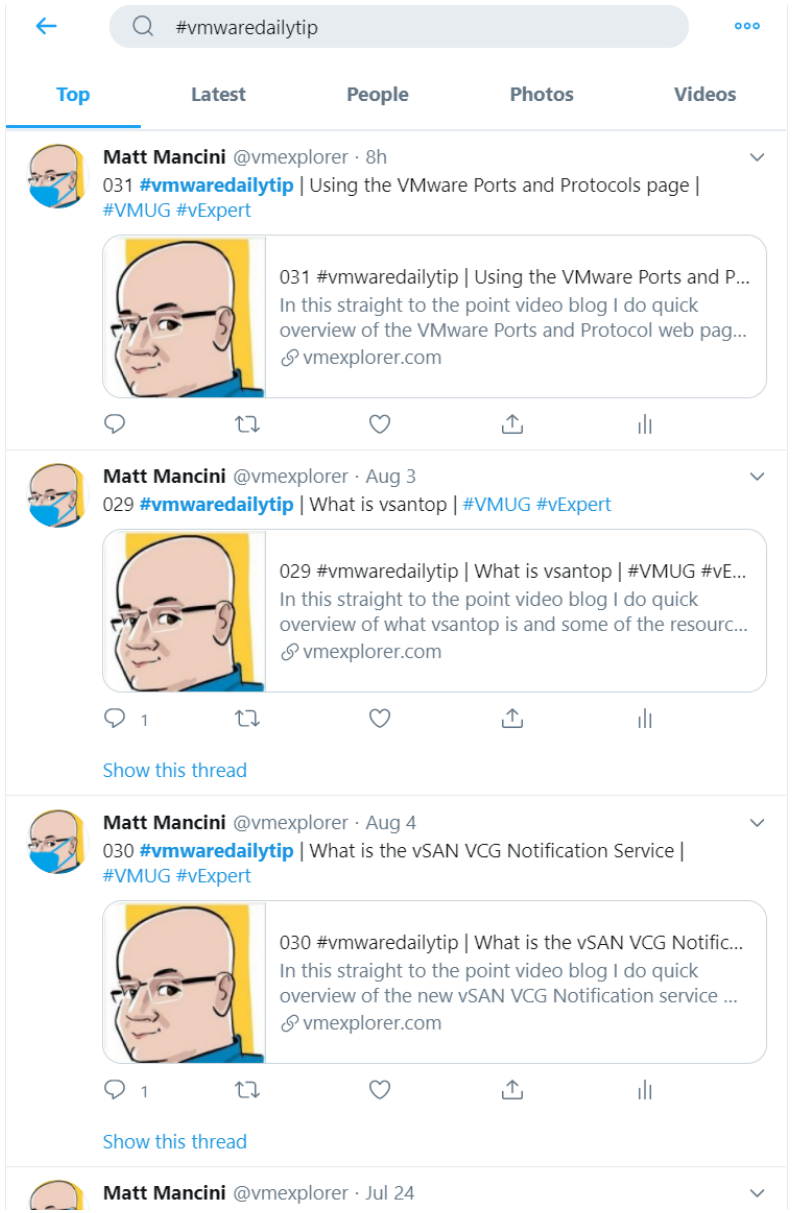
- Dual E5 Xeons (2640v2)
- 128GB RAM DDR3
- vSAN Hybrid
- 10gbe Network (MikroTik)
- 4 x Cisco Switches
- vSphere
  - 6.7U3 (Jinsha x79)
  - 7.0 (SM X9DRD)
- Workstation 15 (i7-8700)
- Plans to install the entire stack

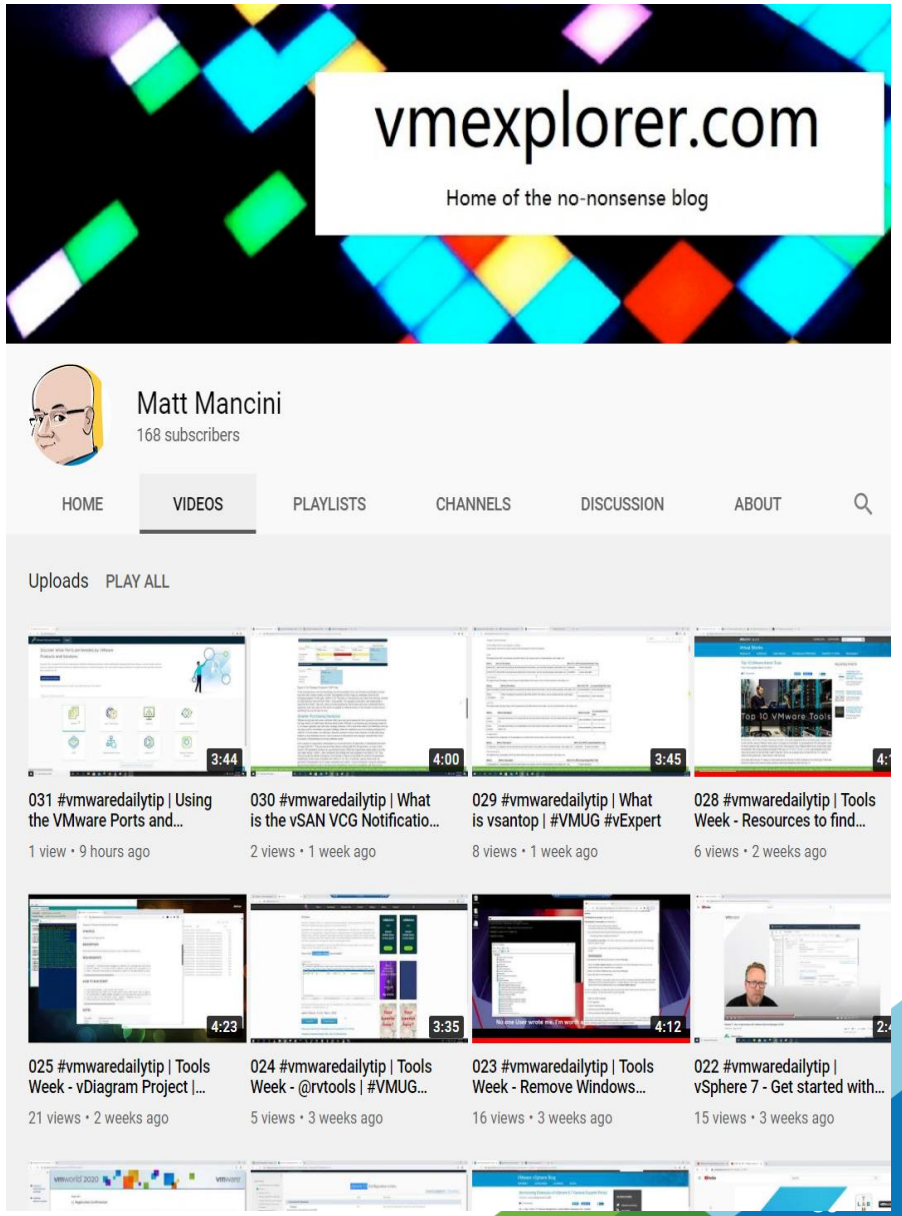
What's next?

- vRNI / NSX / vRealize Stack / K8S
- Solar / Wind Power

Check out vmexplorer.com Blog, YouTube, and Twitter







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Links

- HOL vs Home Lab
- https://vexpert.vmware.com/
- https://visualstudio.microsoft.com/
- https://www.vmug.com/home
- https://mikrotik.com/
- https://www.virtuallyghetto.com/home-lab
- https://www.freenas.org/
- https://www.vmware.com/my-vmware-partners.html
- InfiniBand Links (1) and (2)
- https://configmax.vmware.com/home
- https://www.vmware.com/resources/compatibility/search.php

Porridge is only as good as you make it.

Thank you!