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Overview of advanced storage technologies and storage virtualization

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Introduction

Aims of course

- Improve knowledge on storage technology
  - Understand logical organization of storage I/O
  - Understand relationship with underlying physical infrastructure
  - Understand impact of storage on performance of virtual infrastructure
- Help to make better design and purchase choices, both for software and hardware

Does it matter to me?

Look, I'm going to be a database/e-commerce/multimedia IT engineer, not a SysAdm. Is storage of any importance to me?

- Today, IT firms find economic profit in handling large amounts of data:
  - High-performance databases for commercial transactions
  - Indexing/data mining over BIG databases/sets of data (*Google, oil/gas industry, etc*)
  - Multimedia contents (*YouTube*)

- Social networking is driving data growth out of control
  - Large amounts of useless stuff get also stored
  - Both valuable and useless data must be moved in/out of storage

Does it matter to me?

- Many IT engineers will need to develop applications which handle big data

- IT engineer must be aware on how his design interacts with I/O:
  - The best software system can perform poorly under badly designed I/O
  - The best/most expensive I/O design can be made run poorly by inefficient software or bad configuration

Isn’t spending more money enough?

Today we’ve got systems with bazillions cores. Won’t they handle anything the I/O can throw their way?

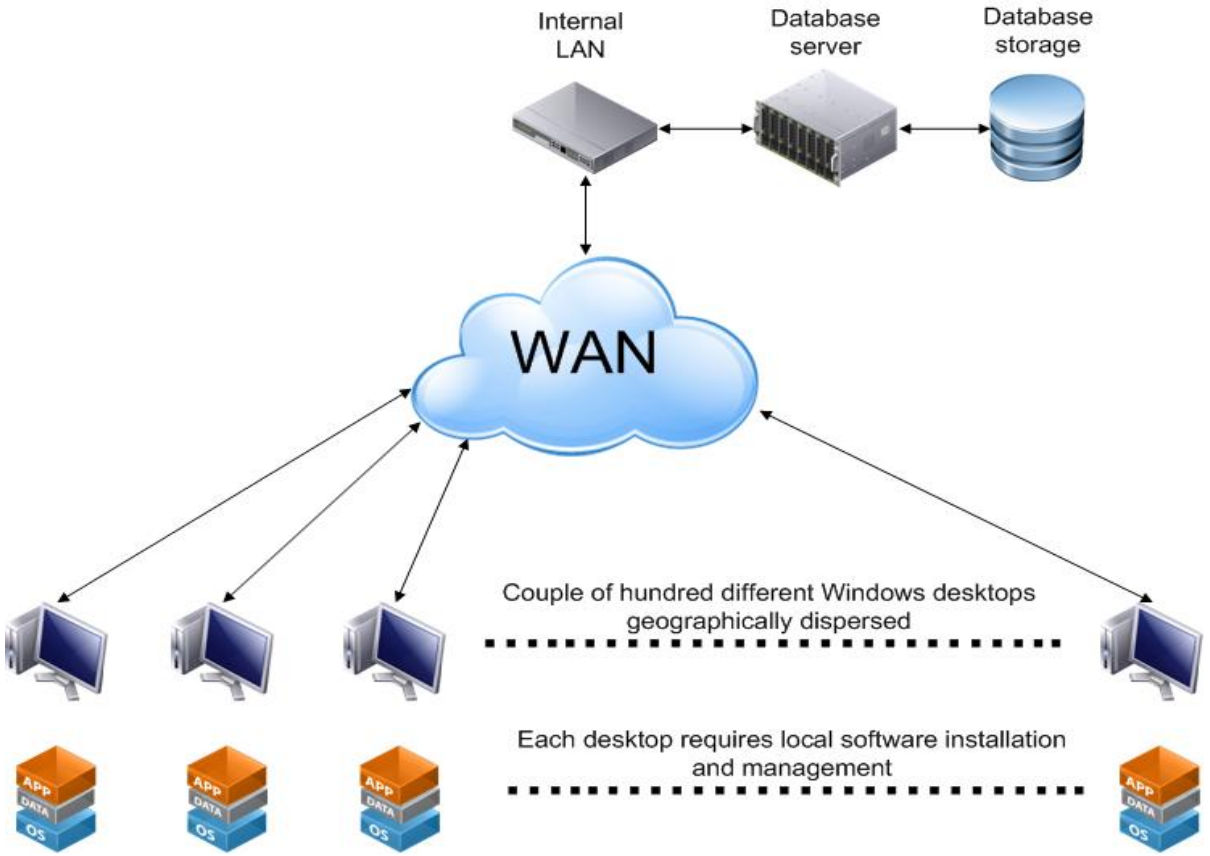
- Unfortunately, no. No matter how many CPU/GPU/cores/RAM you have, I/O bottlenecks can (and will) bring even the most powerful supercomputer to its knees:
  - Processing will stall, and CPUs idle
  - Costs (lots of) money
    - Waste of leased CPU time
    - Waste of electric power and cooling costs
    - Waste of investment in processing power (poor ROI)

Isn’t spending more money enough?

Disks are dirty cheap nowadays. If you’ve got I/O problems, just buy larger/faster storage and you’ll be OK, right?

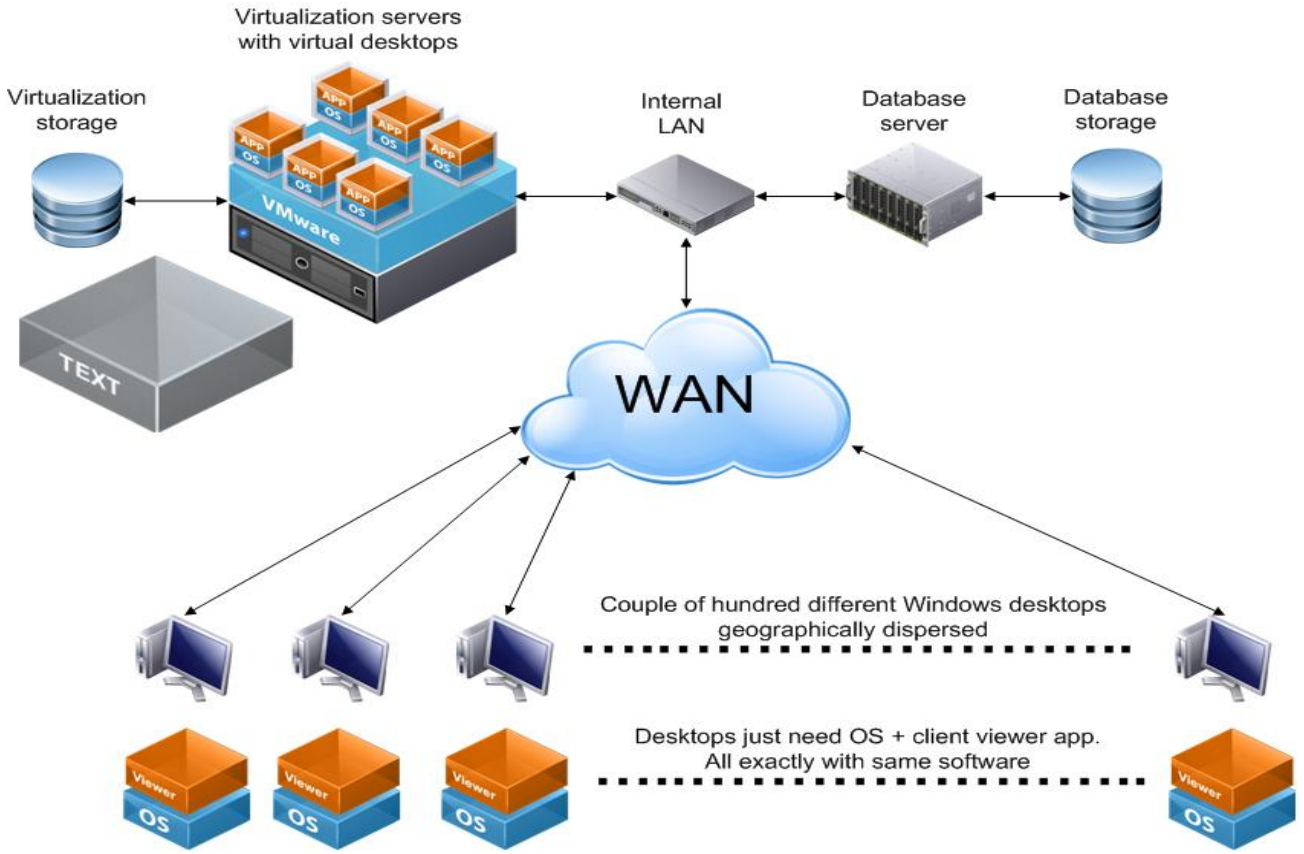
- Not necessarily. Without a clear understanding of the reasons of the bottleneck, you may end just wasting…
  - the firm’s money (lots of it!)
  - the staff time (productivity loss)
  - everyone’s patience with you !!!

Example



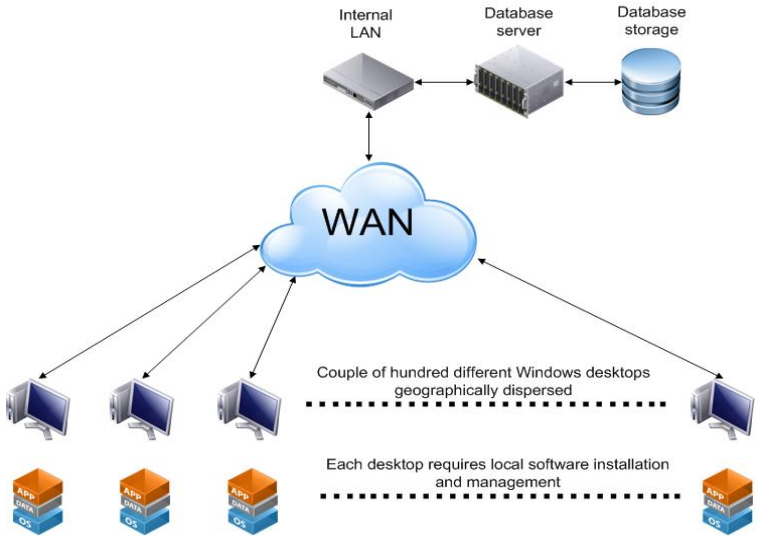
- Firm's management app must be accessed from many separate physical locations
- Each location requires desktop, with OS + App software installed
- High costs of software maintenance

Example



- Under your advice, firm introduces VDI (*Virtual Desktop Infrastructure*)
- Desktops with App run as virtual machines in centralized server
- Physical desktops now are just remote viewing clients
  - Great savings in Opex (Operational Expenses)

Example



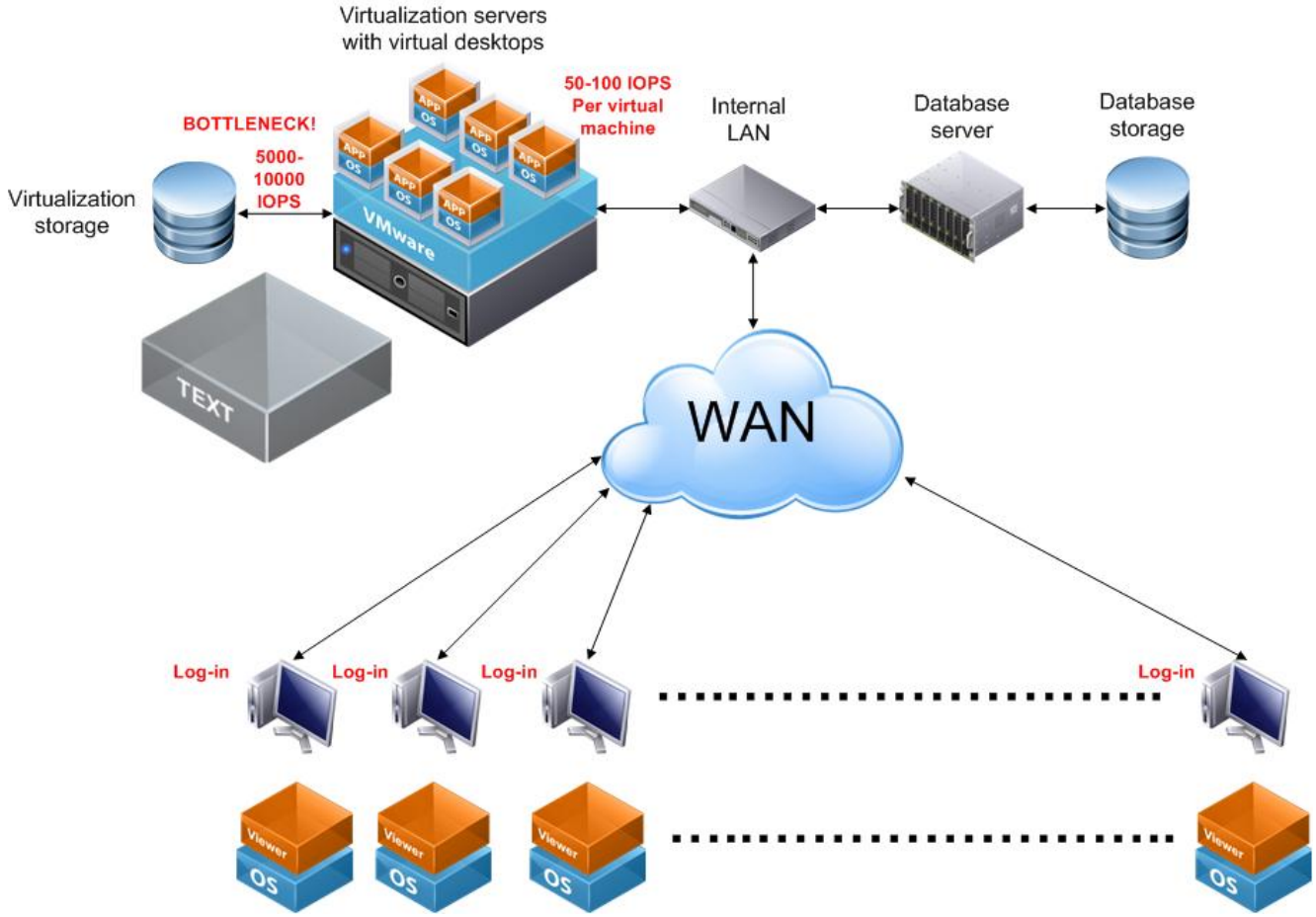
- System turns out to work very well… <u>almost</u>
- Performance of system sinks around opening hour (9:00 am)
  - Login process slows down to a crawl
  - Login and app startup can take up to 5-10 minutes to complete
  - Users can not do any work until login is complete
  - Users get frustrated and angry with new system
  - Users complain to boss
  - Boss gets angry with ***<u>you</u>***

Example

- Your problem is called "*VDI boot storm*"

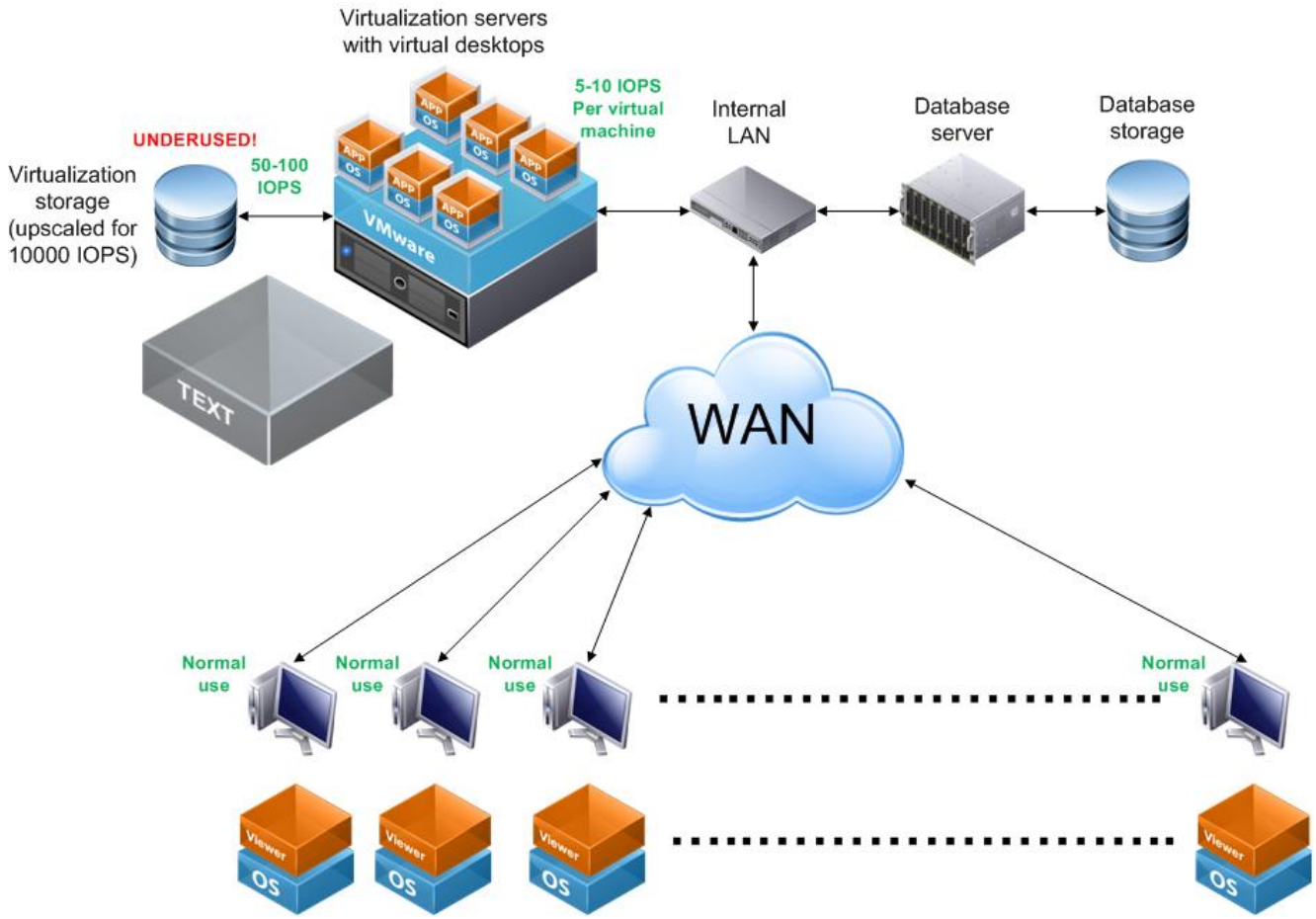
- Workstation login process requires lots of disk access
  - IOPS = I/O Operations Per Second
  - In normal use, workstation generates just 5-10 IOPS
  - While booting, workstation issues 50-100 IOPS

Example



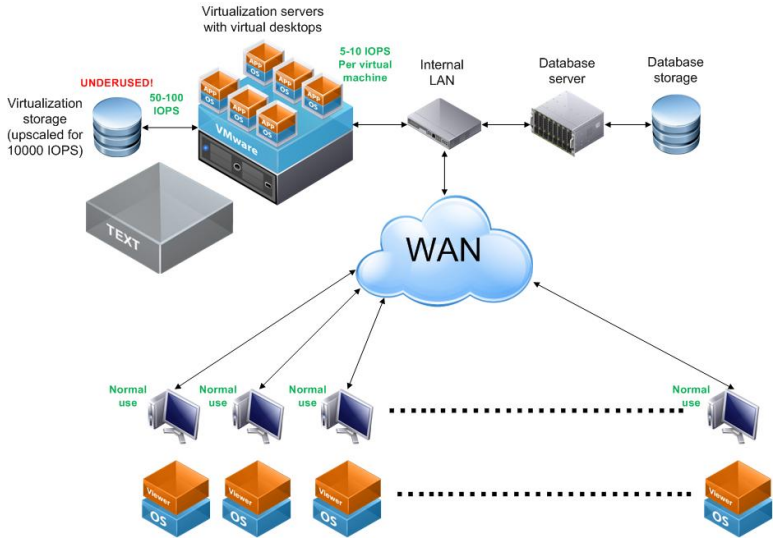
- Virtualization has created a bottleneck, centralizing all IOPS into a single storage appliance

Example



- You solve the problem by brute force, purchasing new storage
  - More disks ("spindles"), faster (15k), much more expensive
  - Probably need to change also disk rack

Example



- Problem: after login is finished, App uses storage at just 1% of possible IOPS
  - System overdimensioned for normal use
  - But power and maintenance costs must be paid for all that excess capacity
  - Storage costs negate any savings from reduced software maintenance
  - Bad ROI (Return Of Inversion)
  - Boss unhappy with ***you***