CLOUD COMPUTING

EGCO342 INFORMATION TECHNOLOGY IN DAILY LIFE

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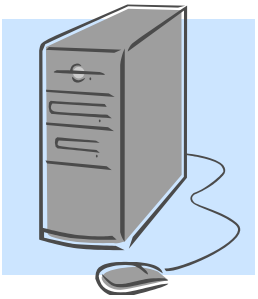
Do you use the cloud ?

The Back Story (1)

- Computers have internal or hard drive storage (C: Drive)
- CPU has a drive for storing programs, documents, pictures, videos, presentations, etc.
- Content is stored on THAT computer
- To use content must return to THAT computer
- Cannot access this content from another device or computer



Standard Computer Tower or Central Processing Unit (CPU)

Inside the Computer

The Back Story (2)

- **Programs**
  - Purchase programs
  - Load to the computer
  - Each computer would need the program loaded and stored on the internal drive


The Back Story (3)

- **External Storage**
  - Allows your content to become mobile
  - Save to the storage device
  - Take device to any compatible computer
  - Open and use content

CD/DVD

Thumb Drive

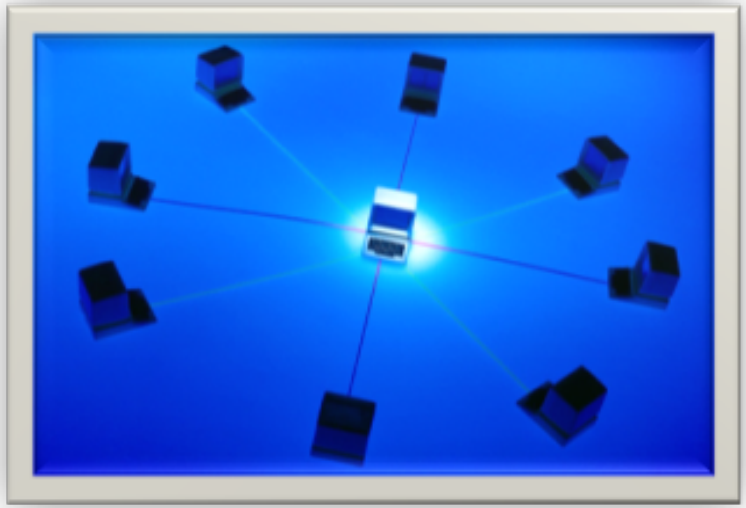
External Hard Drive

SD Card

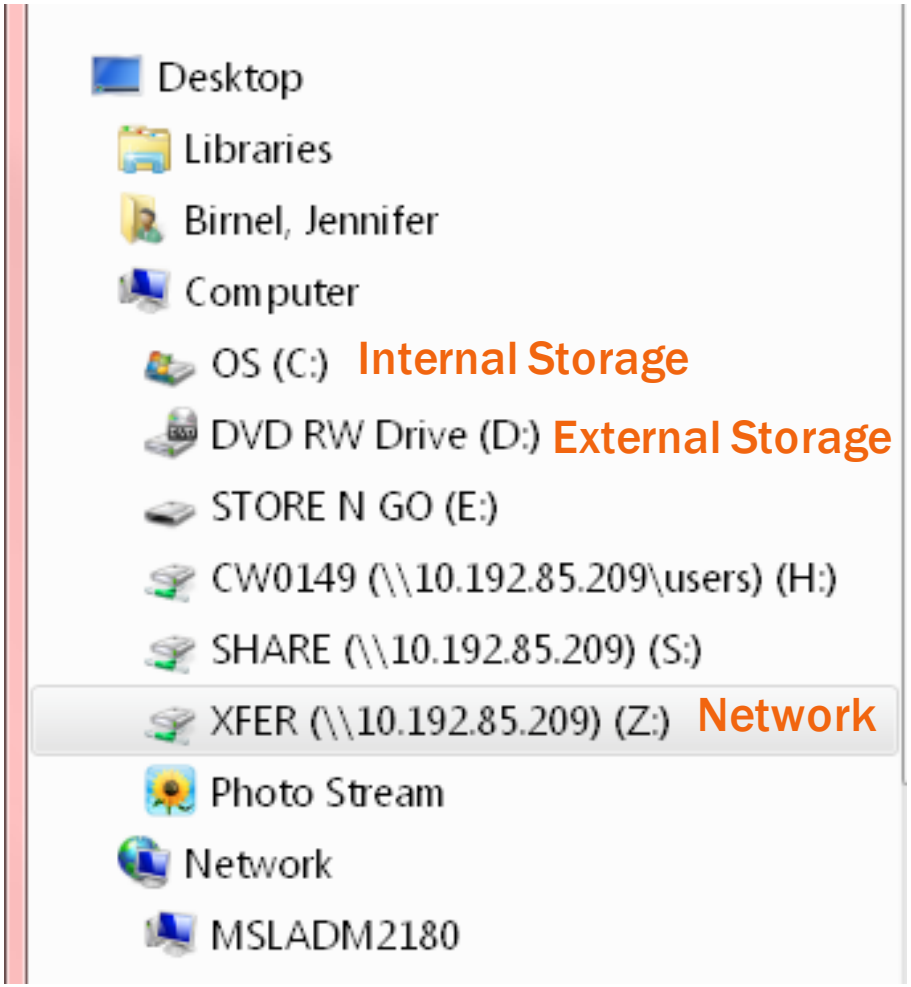
Micro SD Card

The Back Story (4)

- **Networked Storage**
  - Multiple work stations talk to one unit that stores information and data.
  - Data is not saved to the C: drive, but to a network drive
  - Can retrieve the data stored to the network from any of the connected workstations.



The Back Story (5)



- Saving documents
  - When you do a “save as” on your computer, you choose where to save the material.

Cloud Storage

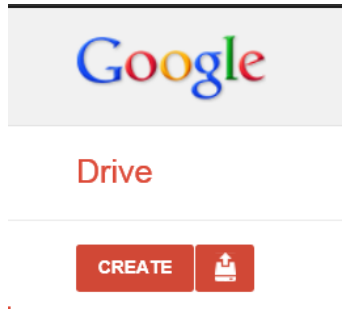
- Create an Account – User name and password
- Content lives with the account in the cloud
- Log onto any computer with Wi-Fi to find your content

Downloads for storage

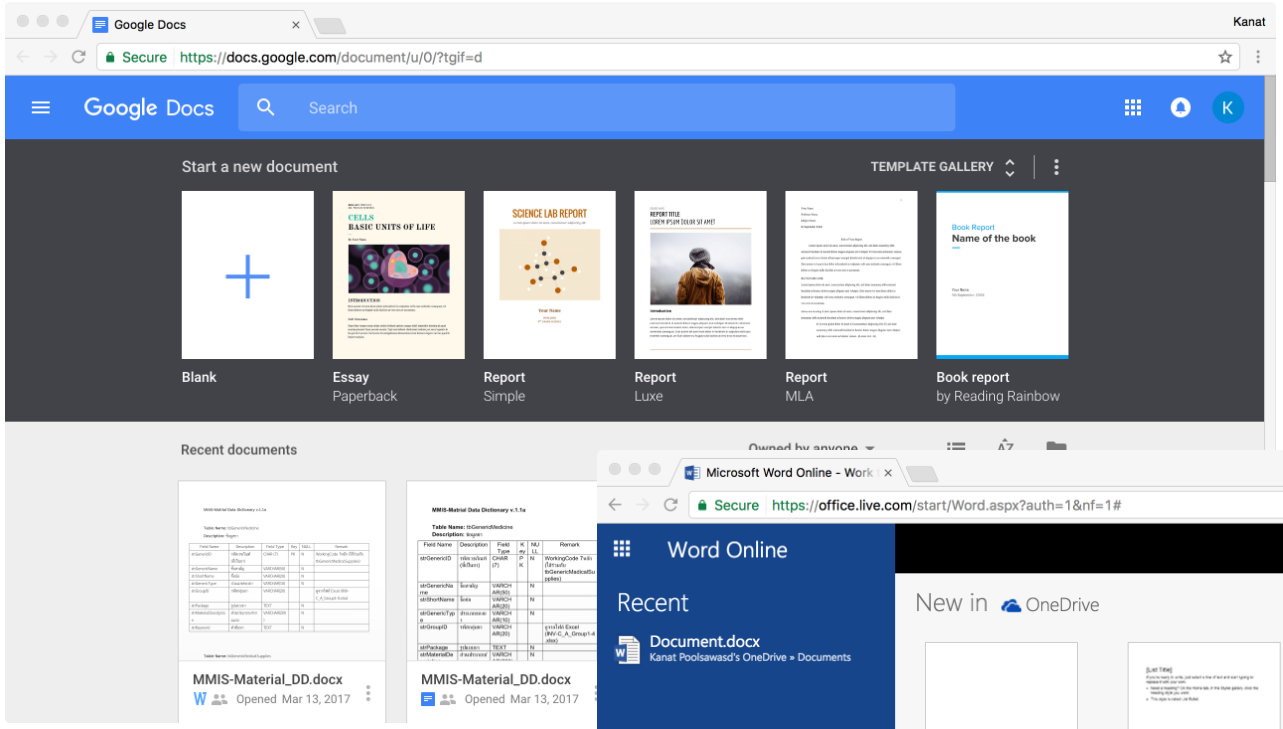
- Download a cloud based app to a computer you own
- The app lives on your Computer
- Save files to the app
- When connected to the Internet it will sync with the cloud
- The Cloud can be accessed from any Internet connection

Save/Upload Files

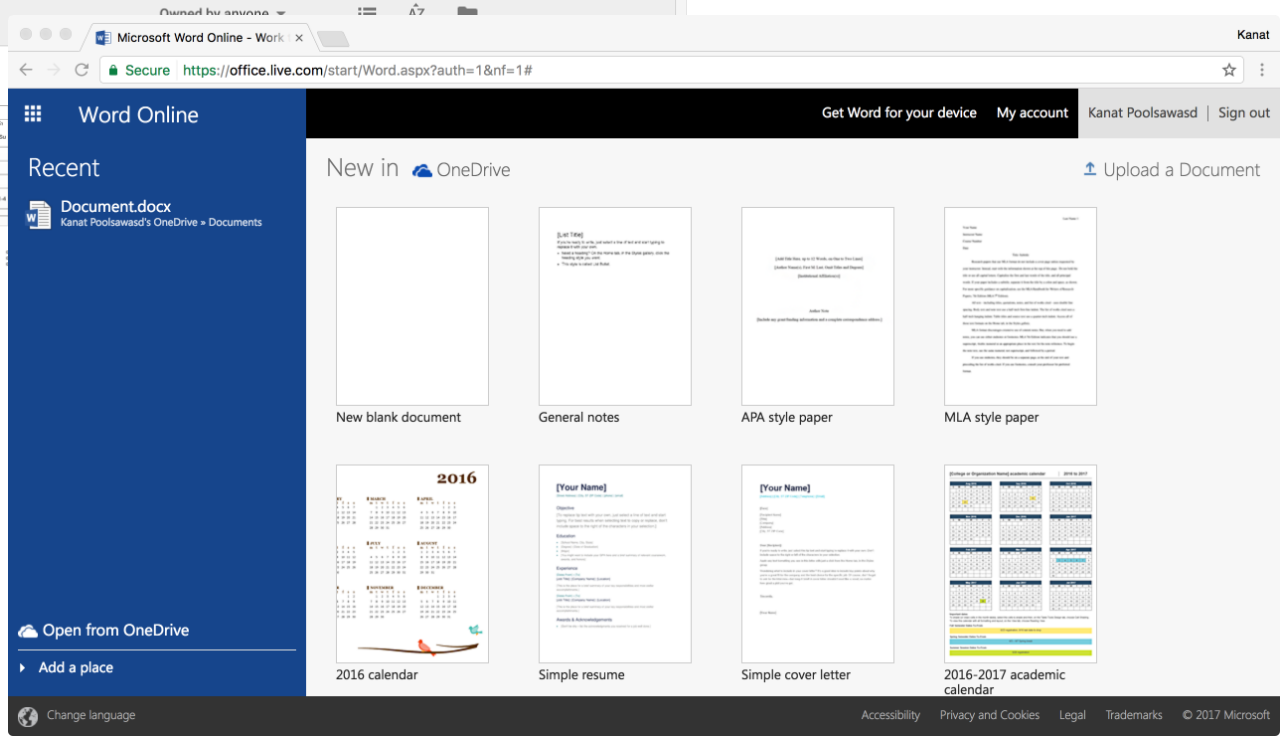
- Do “save as” to save a file to your computer and the cloud
- The syncing folders makes data retrieval easier
- Box and DropBox require this download to work
- Log-in to the online storage account
- Click upload a file
- Find the file on hard drive, network, or external storage
- Upload to cloud storage



More than storage (1)

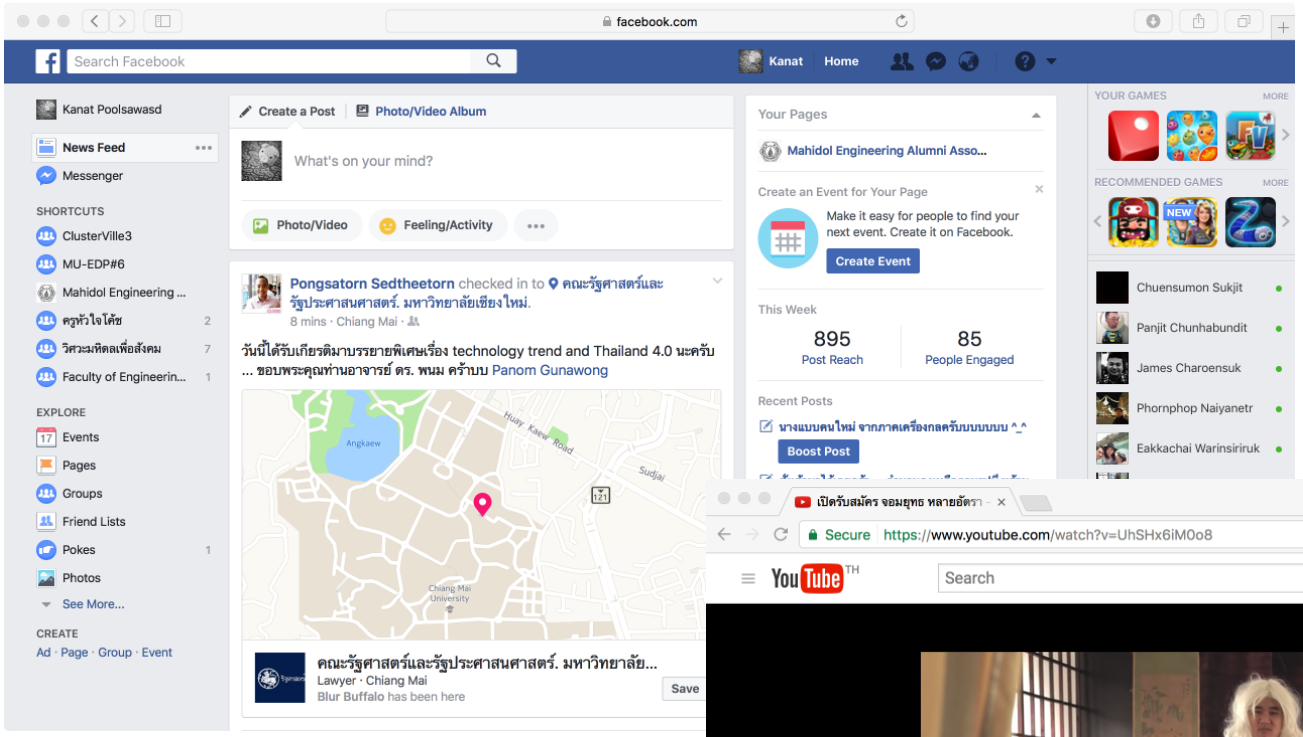


Google Docs

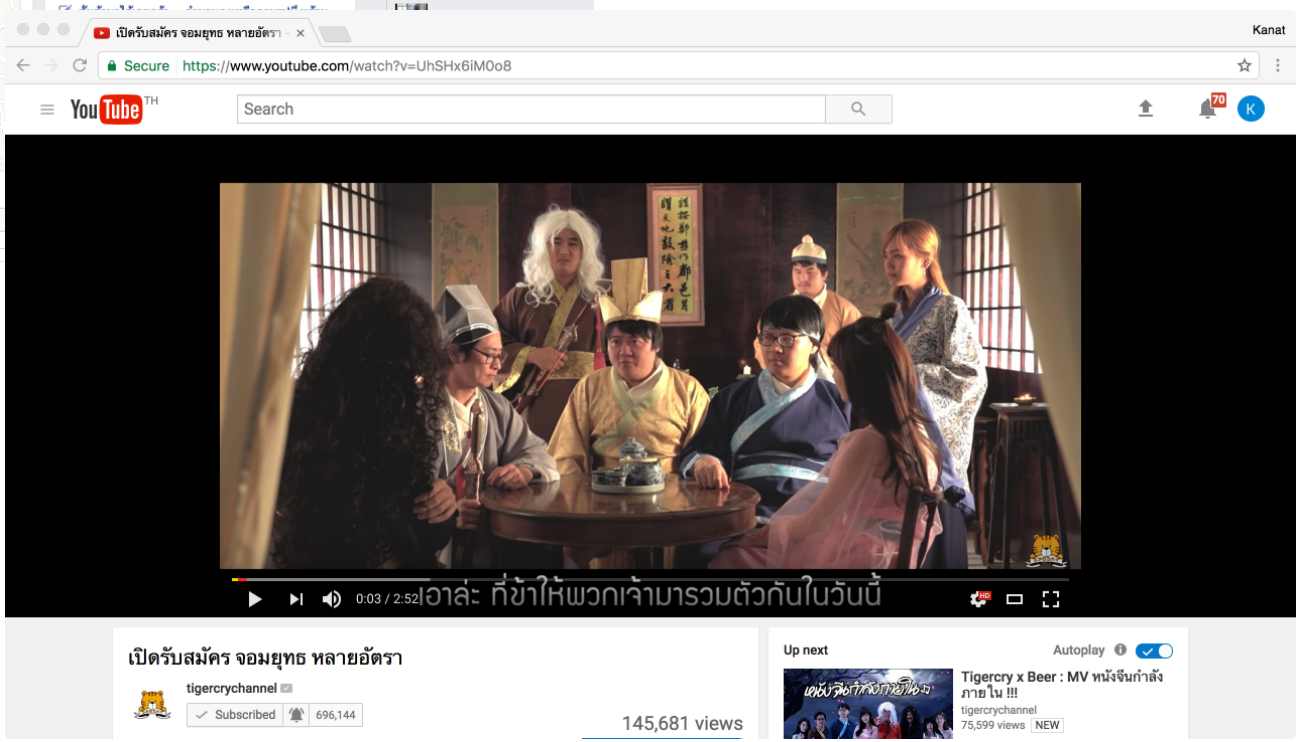


Word Online

More than storage (2)

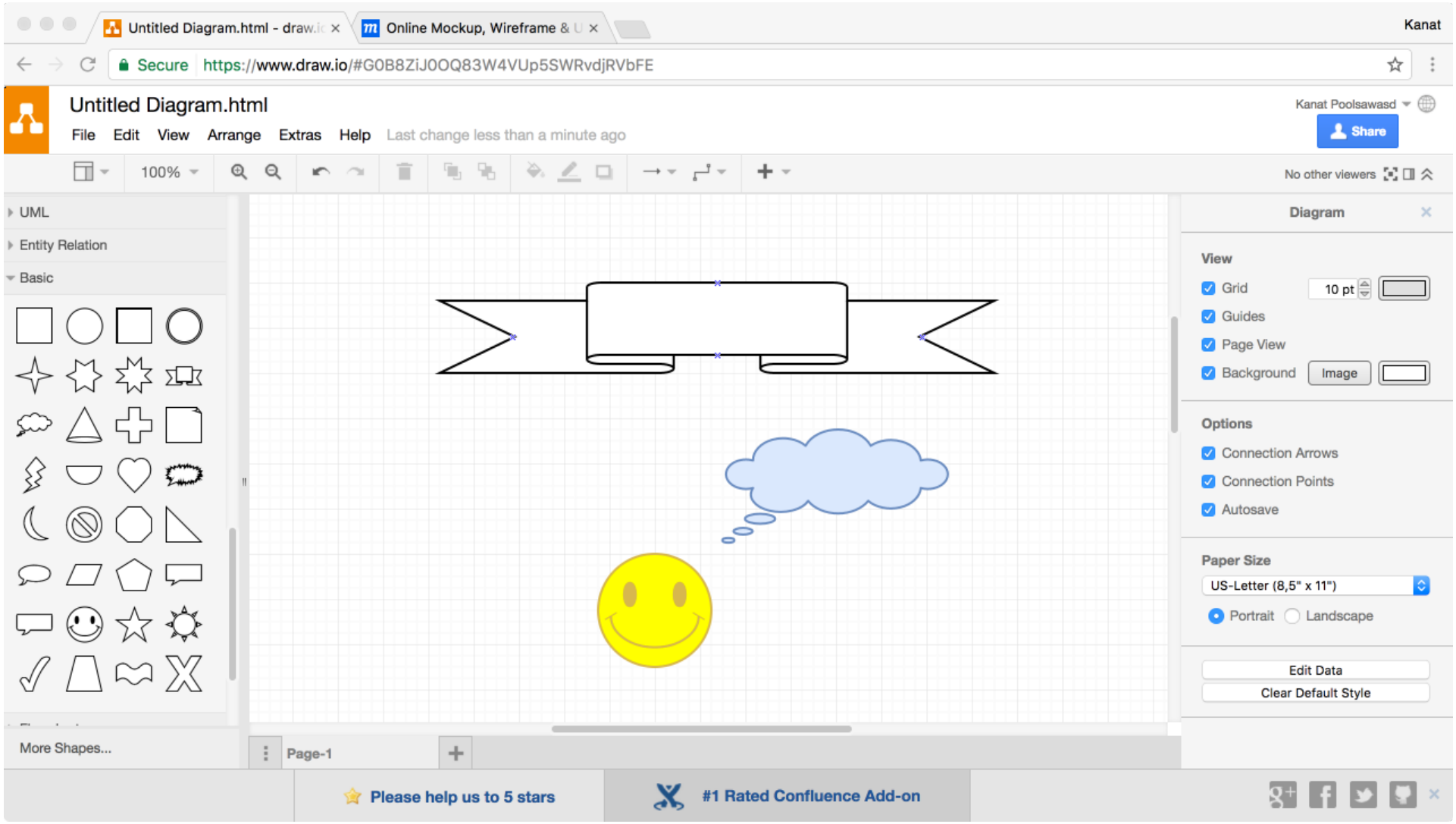


facebook.com

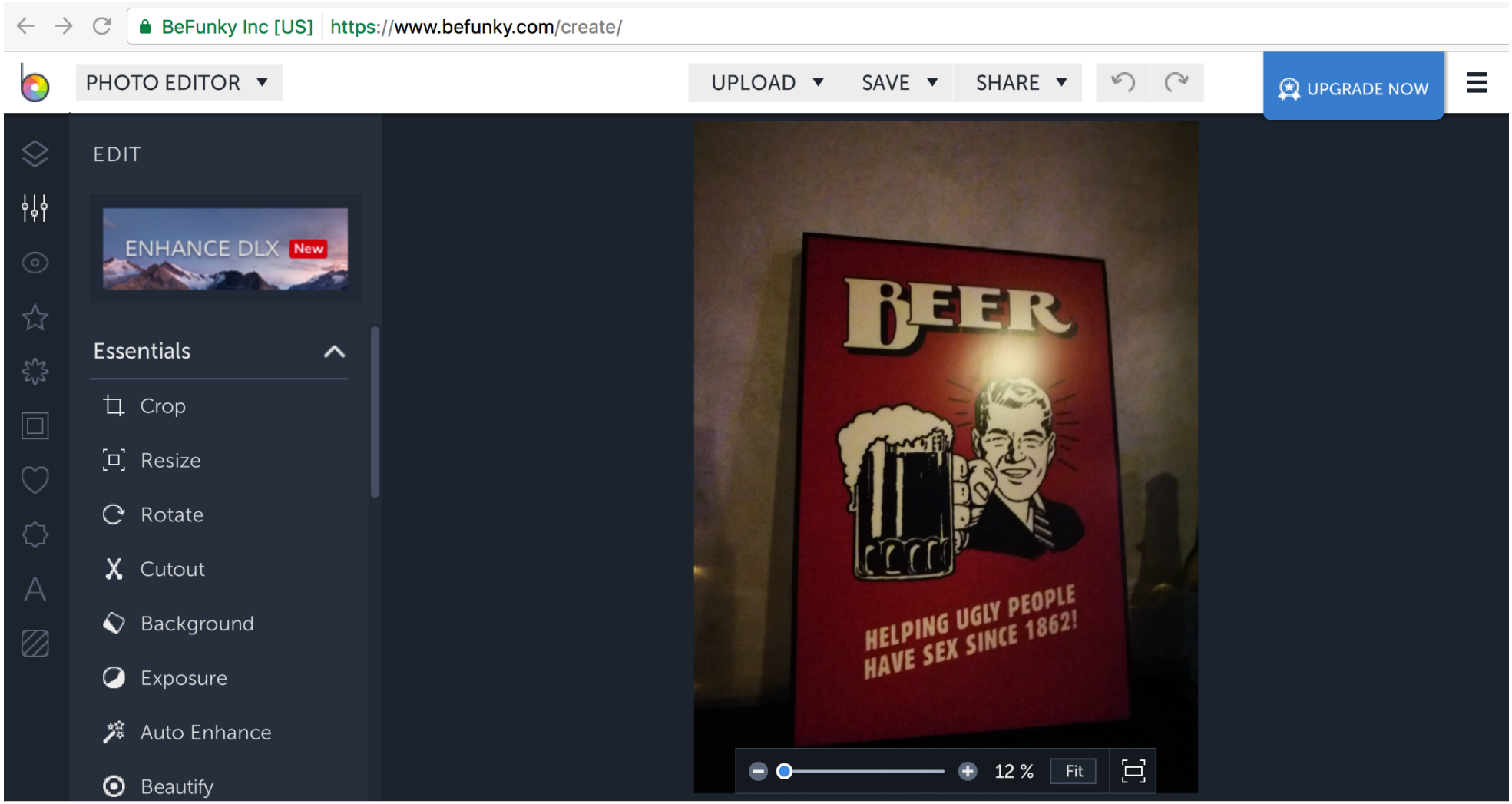


youtube.com

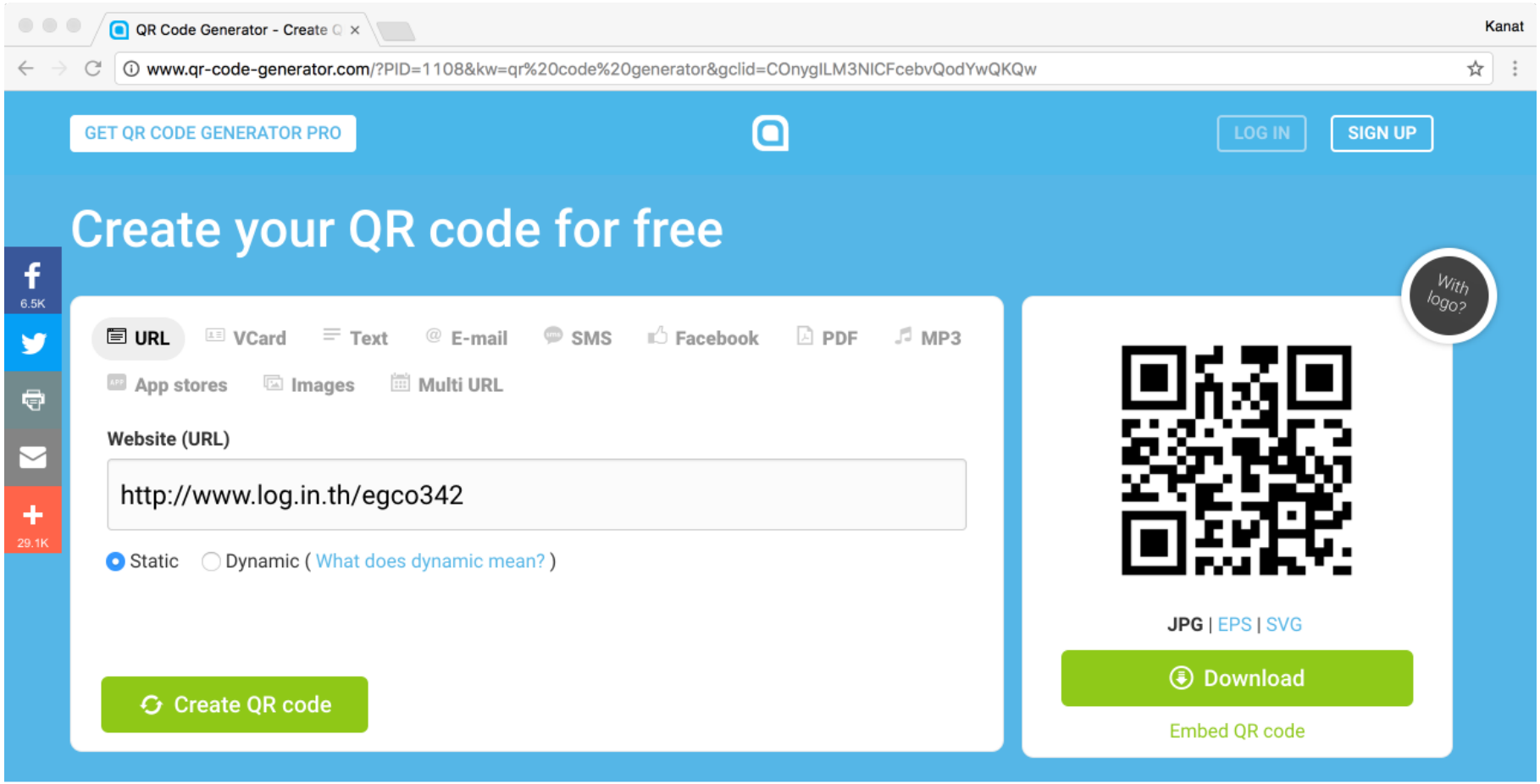
More example: draw.io



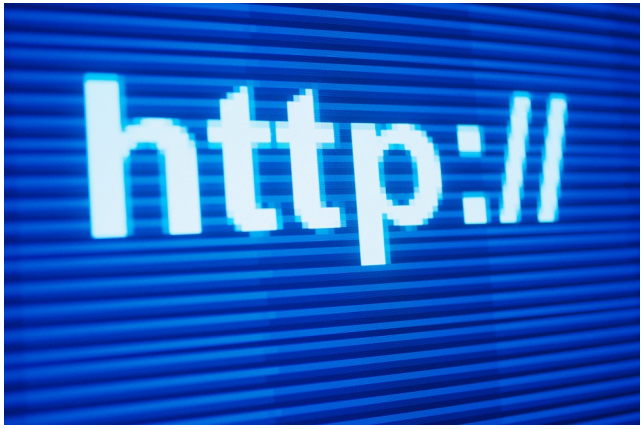
More example: befunky.com



More example: qr-code-generator.com



Internet is required

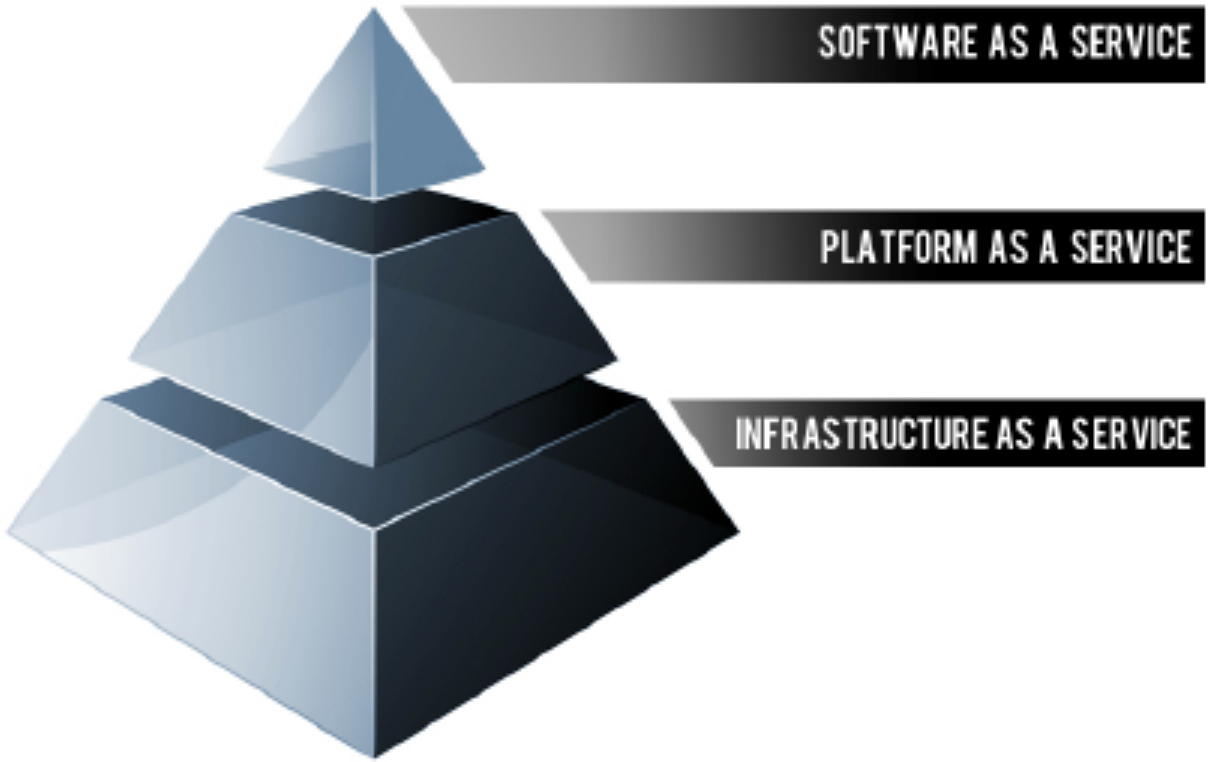


- Creation is happening in the cloud
- Saving is going to the cloud
- To retrieve files, must return to the cloud

Benefits

- Saving Large Files
- Multiple file types – Photos, videos, presentations, docs
- Back-up of stored files
- File Sharing
- Access from devices
- Nothing to forget (thumb drive, cd)
- Project collaboration

The Cloud Computing Stack



Software as a Service (SaaS)

- Software as a Service (SaaS) is software that is deployed over the internet.
- A provider licenses an application to customers either as a service on demand, through a subscription, in a “pay-as-you-go” model, or (increasingly) at no charge when there is opportunity to generate revenue from streams other than the user, such as from advertisement or user list sales
- *Examples: Google Apps, Salesforce, Nivio, Learn.com.*

Characteristics of SaaS

- Web access to commercial software
- Software is managed from a central location
- Software delivered in a “one to many” model
- Users not required to handle software upgrades and patches
- Application Programming Interfaces (APIs) allow for integration between different pieces of software

Platform as a Service (PaaS)

- Platform as a Service (PaaS) brings the benefits that SaaS bought for applications, but over to the software development world. PaaS can be defined as a computing platform that allows the creation of web applications quickly and easily and without the complexity of buying and maintaining the software and infrastructure underneath it.
- PaaS is analogous to SaaS except that, rather than being software delivered over the web, it is a platform for the creation of software, delivered over the web.
- *Examples: Windows Azure, Google App.*

Characteristics of PaaS

- Services to develop, test, deploy, host and maintain applications in the same integrated development environment.
- Web based user interface creation tools help to create, modify, test and deploy different UI scenarios
- Built in scalability of deployed software including load balancing and failover
- Integration with web services and databases via common standards
- Support for development team collaboration – some PaaS solutions include project planning and communication tools
- Tools to handle billing and subscription management

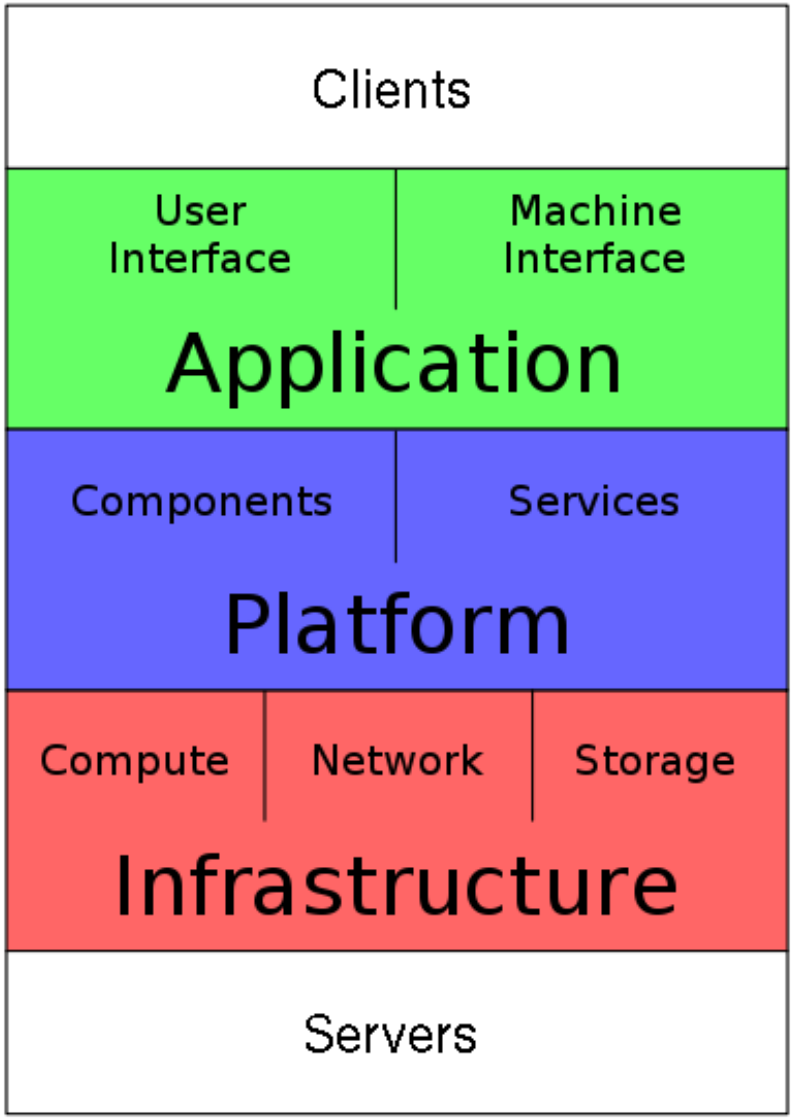
Infrastructure as a Service (IaaS)

- Infrastructure as a Service (IaaS) is a way of delivering Cloud Computing infrastructure – servers, storage, network and operating systems – as an on-demand service. Rather than purchasing servers, software, datacenter space or network equipment, clients instead buy those resources as a fully outsourced service on demand
- *Examples: Amazon EC2, GoGrid, iland, Rackspace Cloud Servers, ReliaCloud.*

Characteristics of IaaS

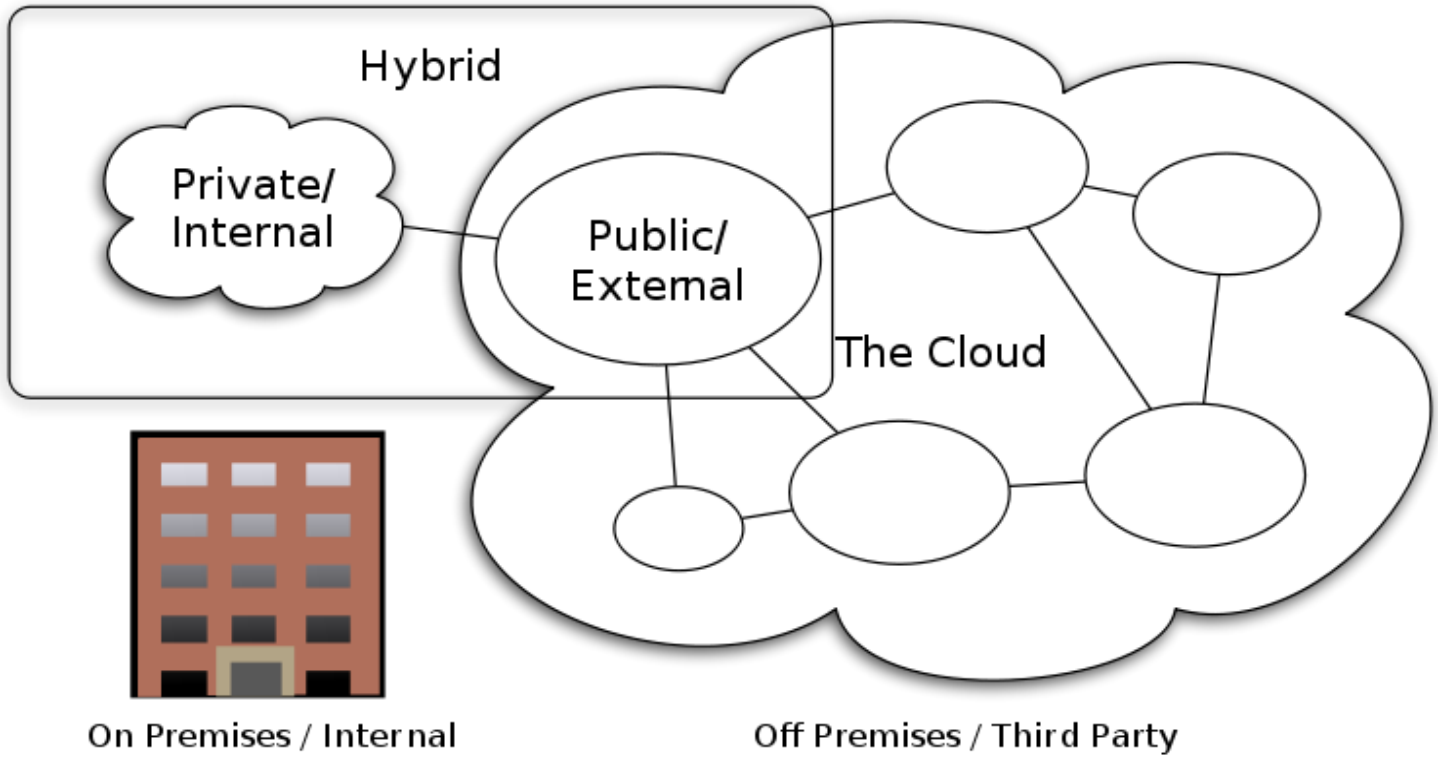
- Resources are distributed as a service
- Allows for dynamic scaling
- Has a variable cost, utility pricing model
- Generally includes multiple users on a single piece of hardware

Service Model



Cloud Computing Stack

Deployment Model



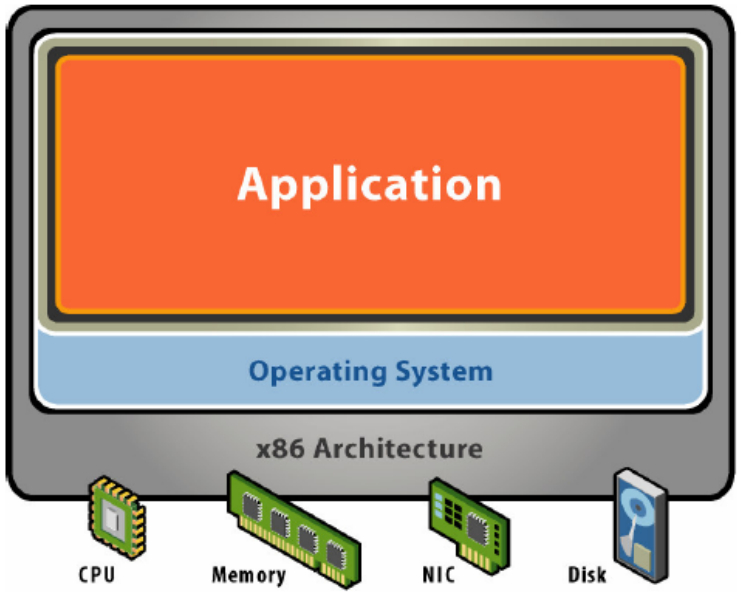
Cloud Computing Types

Virtual Machine (1)

- A virtual machine (VM) is an operating system OS or application environment that is installed on software which imitates dedicated hardware. The end user has the same experience on a virtual machine as they would have on dedicated hardware
- Players
  - VMWare
  - VirtualBox
  - Windows Virtual PC
  - QEMU

Virtual Machine (2)

Starting Point: A Physical Machine



Physical Hardware

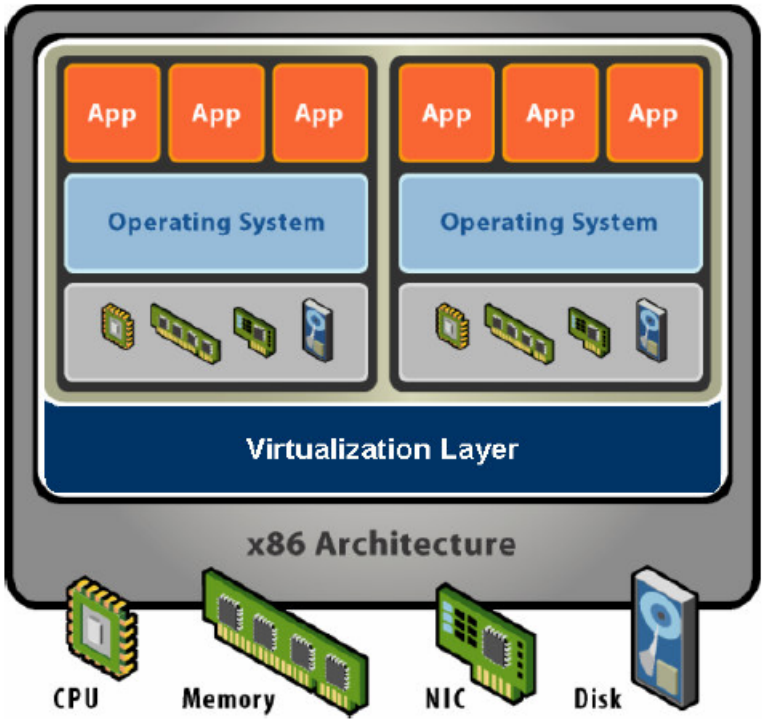
- Processors, memory, chipset, I/O bus and devices, etc.
- Physical resources often underutilized

Software

- Tightly coupled to hardware
- Single active OS image
- OS controls hardware

Virtual Machine (3)

What is a Virtual Machine?



Hardware-Level Abstraction

- Virtual hardware: processors, memory, chipset, I/O devices, etc.
- Encapsulates all OS and application state

Virtualization Software

- Extra level of indirection decouples hardware and OS
- Multiplexes physical hardware across multiple “guest” VMs
- Strong isolation between VMs
- Manages physical resources, improves utilization

Virtual Machine (4)

- Host Operating System:
  - The operating system actually running on the hardware
  - Together with virtualization layer, it simulates environment for …
- Guest Operating System:
  - The operating system running in the simulated environment
  - E.g., the one we are trying to debug

Characteristics of Virtual Machine (1)

VM Isolation

Secure Multiplexing

- Run multiple VMs on single physical host
- Processor hardware isolates VMs, *e.g.* MMU

Strong Guarantees

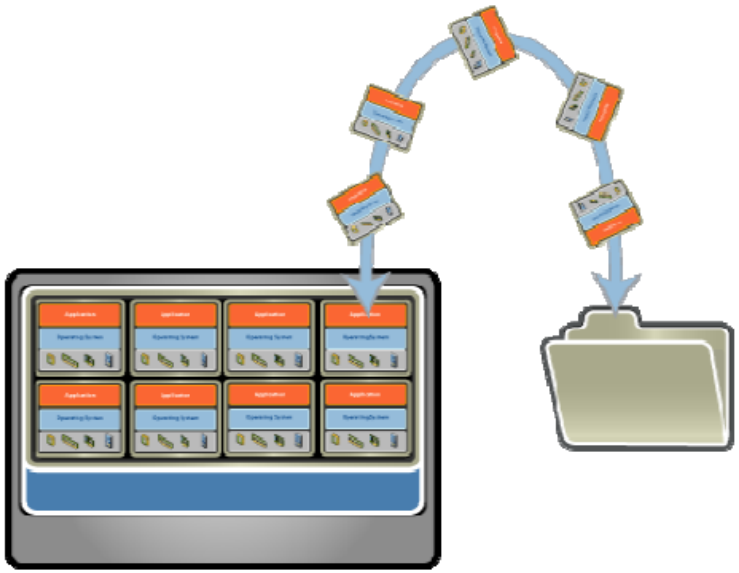
- Software bugs, crashes, viruses within one VM cannot affect other VMs

Performance Isolation

- Partition system resources
- Example: VMware controls for reservation, limit, shares

Characteristics of Virtual Machine (2)

VM Encapsulation



Entire VM is a File

- OS, applications, data
- Memory and device state

Snapshots and Clones

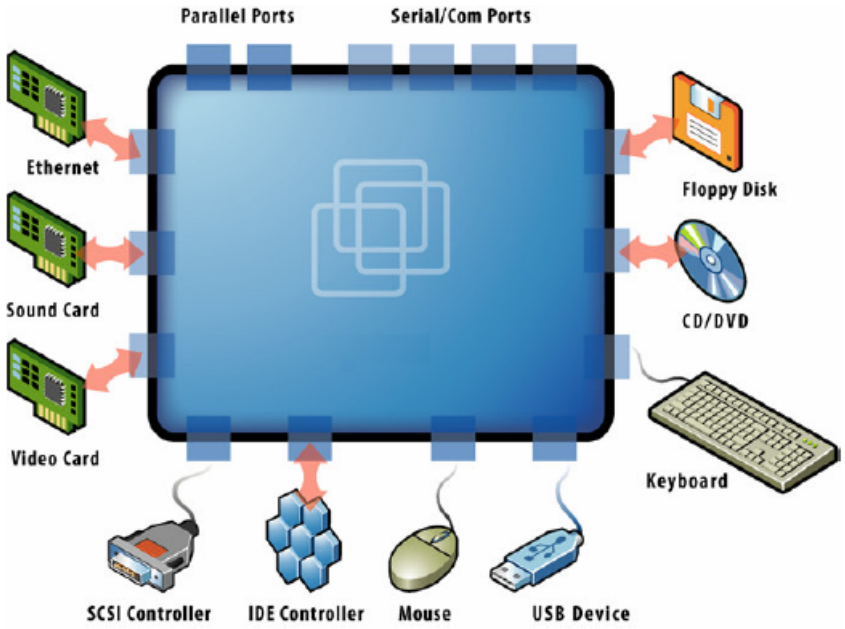
- Capture VM state on the fly and restore to point-in-time
- Rapid system provisioning, backup, remote mirroring

Easy Content Distribution

- Pre-configured apps, demos
- Virtual appliances

Characteristics of Virtual Machine (3)

VM Compatibility



Hardware-Independent

- Physical hardware hidden by virtualization layer
- Standard virtual hardware exposed to VM

Create Once, Run Anywhere

- No configuration issues
- Migrate VMs between hosts

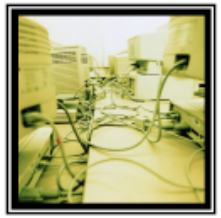
Legacy VMs

- Run ancient OS on new platform
- *E.g.* DOS VM drives virtual IDE and vLance devices, mapped to modern SAN and GigE hardware

Common Virtualization Uses Today (1)

Test and Development – Rapidly provision test and development servers; store libraries of pre-configured test machines

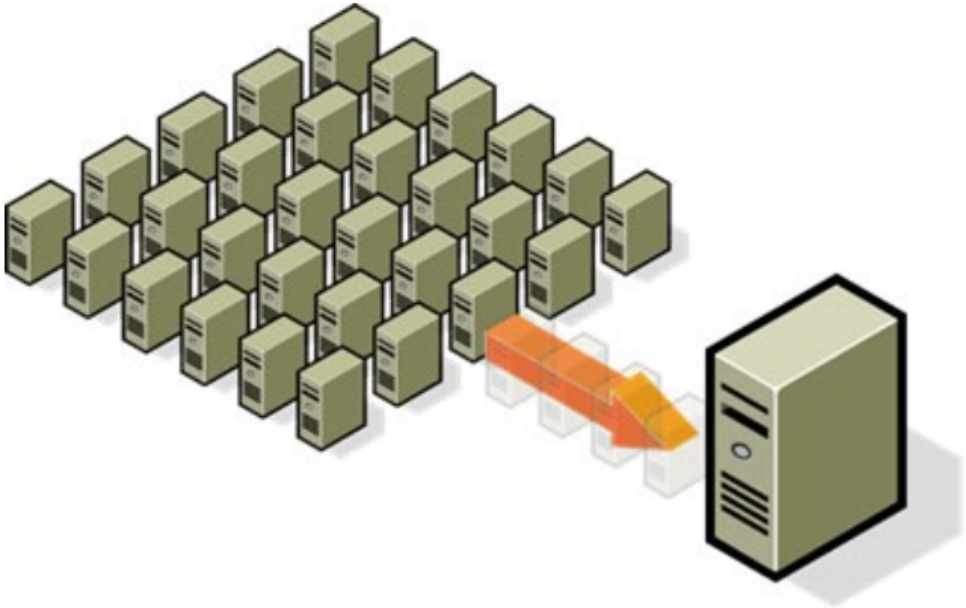
Business Continuity – Reduce cost and complexity by encapsulating entire systems into single files that can be replicated and restored onto any target server



Enterprise Desktop – Secure unmanaged PCs without compromising end-user autonomy by layering a security policy in software around desktop virtual machines

Common Virtualization Uses Today (2)

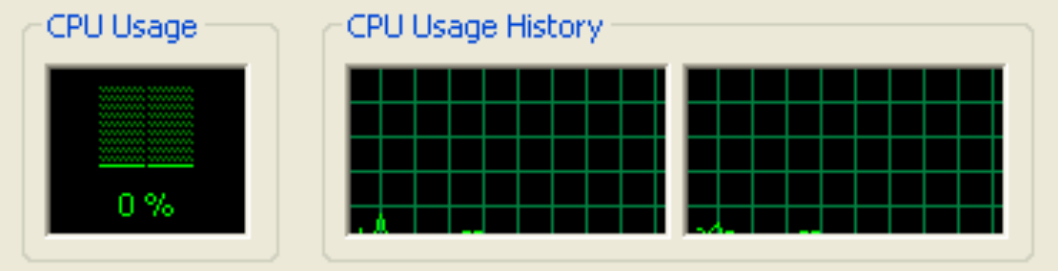
- Reduce costs by consolidating services onto the fewest number of physical machines



http://www.vmware.com/img/serverconsolidation.jpg

Non-Virtualized Data Centers

- Too many servers for too little work

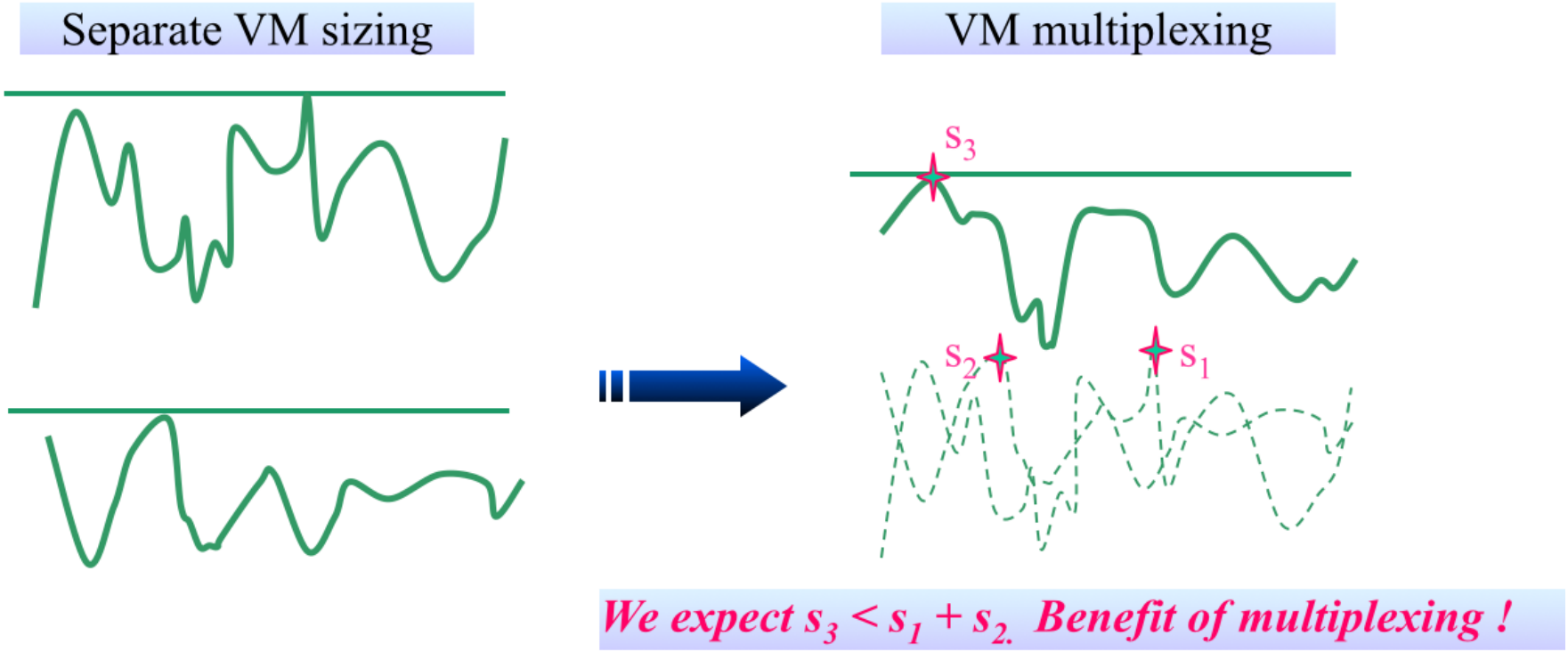


- High costs and infrastructure needs
- Maintenance
- Networking
- Floor space
- Cooling
- Power
- Disaster Recovery

Dynamic Data Center

- Virtualization helps us break the “one service per server” model
- Consolidate many services into a fewer number of machines when workload is low, reducing costs
- Conversely, as demand for a particular service increases, we can shift more virtual machines to run that service
- We can build a data center with fewer total resources, since resources are used as needed instead of being dedicated to single services

VM Workload Multiplexing



Build a School in the Cloud

By Sugata Mitra

Assignment 5

- Cloud for Education
  - ให้แต่ละกลุ่มกลับไปปรึกษากันว่าจากเนื้อหาทั้งหมดที่ได้เรียนกันเกี่ยวกับ Cloud System แบบต่าง ๆ แล้ว เราจะนำไปประยุกต์ใช้เพื่อช่วยในการเรียนรู้ของ “นักศึกษา” ในมหาวิทยาลัยมหิดลได้อย่างไรบ้าง