Introduction to Cloud Computing

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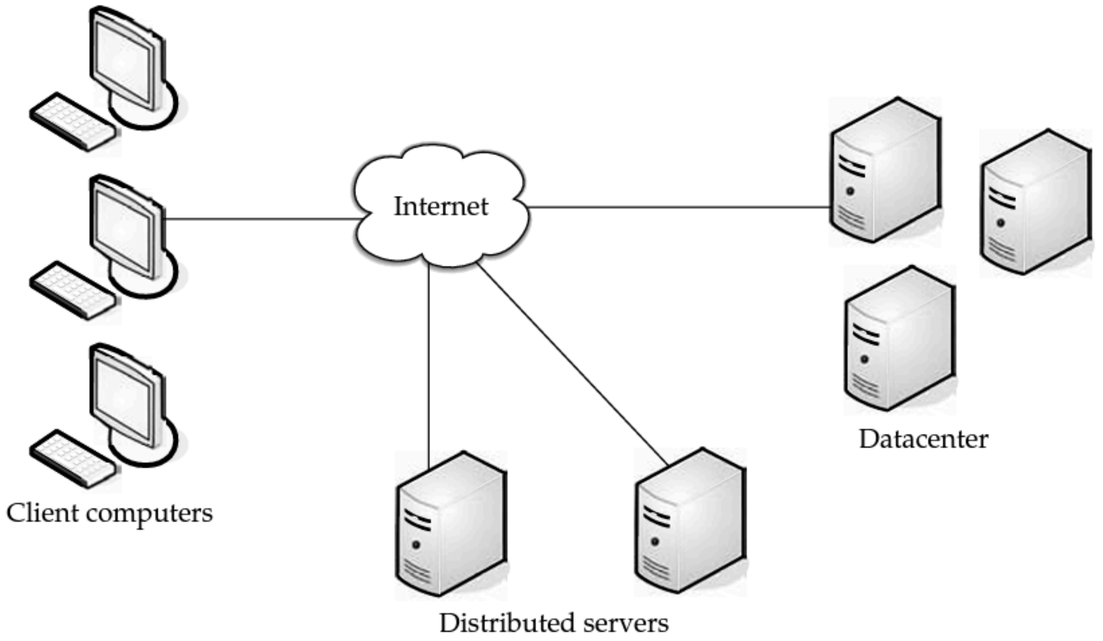
What is Cloud Computing?

What is Cloud Computing?

- Cloud computing is the delivery of computing services over the Internet (“the cloud”)
  - computation, storage, databases, networking, any software or hardware
- Three key components in cloud
  - Clients
  - Datacenter
  - Distributed servers



Why do we need the “cloud”?

- Old view of computing = Mainframes
  - Giant machines
  - Isolated (sort of)
  - expensive specialized hardware
  - specialist programmers doing “specialized” computing that few others understood.
    - Weather modeling, simulations, etc.

Why do we need the “cloud”?

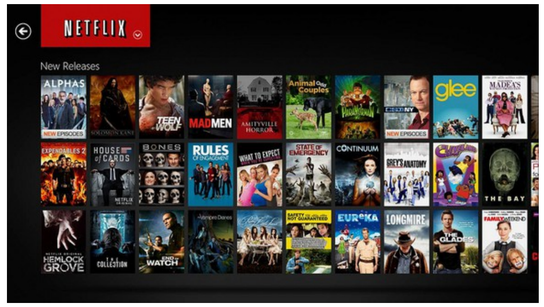
- A little less older view = Personal computing
  - Computing for the masses: Almost anyone can use.
  - Small boxes, sitting on our desk, laptop, palm, wrist, etc
  - Cheap commodity hardware
  - Almost anyone with some skill can program
- Then came the “Internet”…

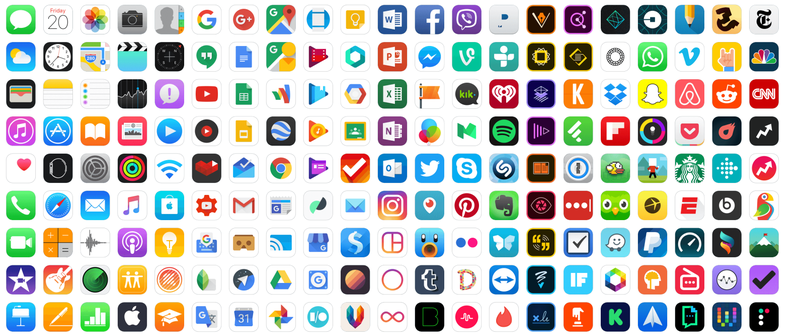
Why do we need the “cloud”?

- Modern view of computing: The Internet is the “box”
  - Supercharged “personal” computing.
  - Our “personal” computer is just a front-end to a more powerful “cloud” computer.
  - Internet started with simple distributed apps
    - like email, file transfer, chat rooms, etc
  - but morphed into “all apps on the cloud” model.

Examples of common cloud products

- Entertainment: Netflix, Youtube, Spotify etc.
- e-Commerce: Amazon, Walmart, etc.
- Web email (Gmail, Yahoo, Outlook, etc)
- Productivity apps: Google Docs, Office 365, etc
- Cloud storage: Google Drive, iCloud, Dropbox
- Online Gaming
- Social media: Instagram, Facebook, X, Linkedin, etc
- Infrastructure-as-service: Rent “virtual” machines on the cloud
- X-as-a-service: X = Platform, software, security, hardware, etc.
- Internet of things (IoT)
  - connect your fridge, washing machine, car, doorbell etc to the cloud





amazon web services™

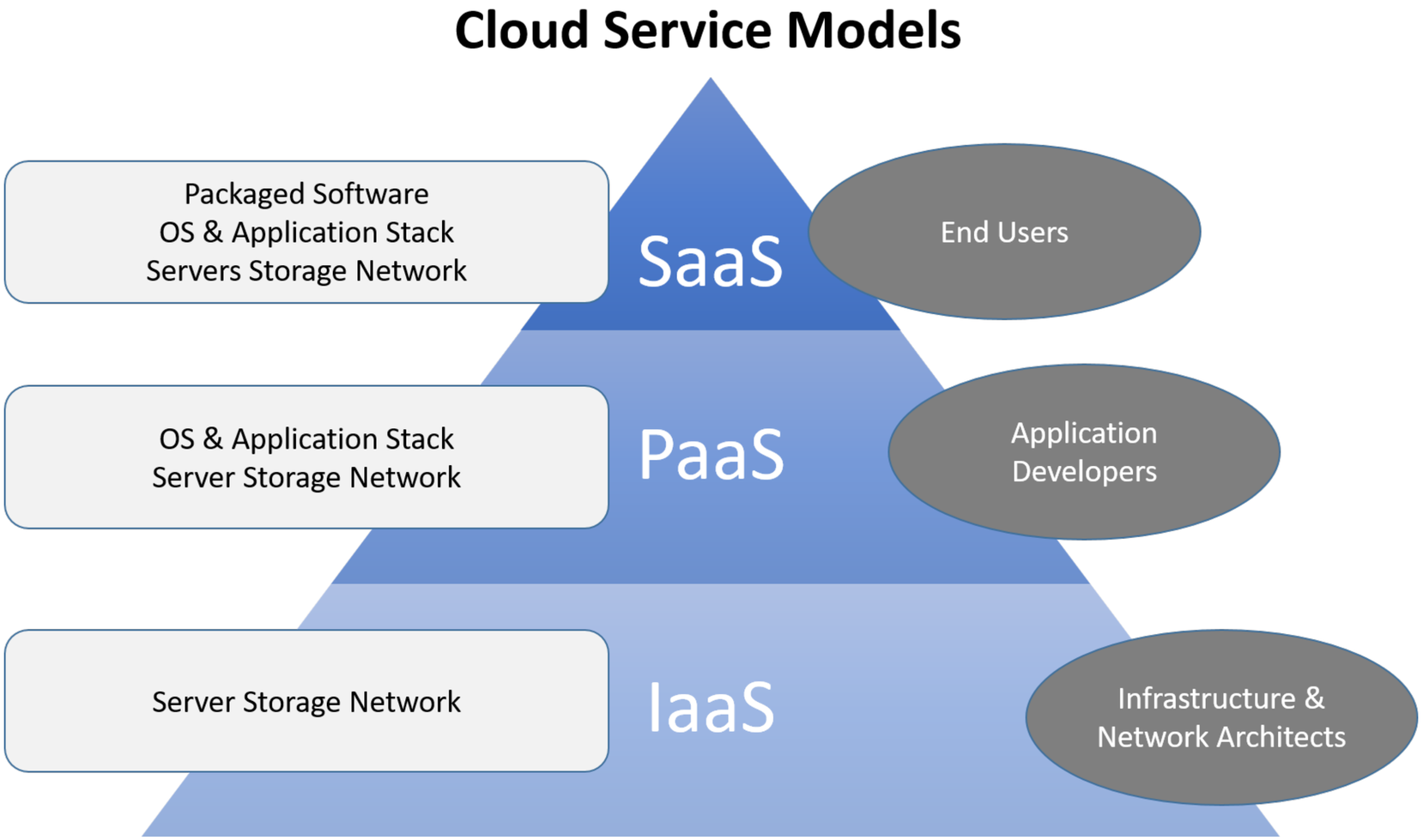
But…Why do we really need the “cloud”?

- Users want to be more connected
  - Share their data, collaborate
- Users want to do more powerful computations
  - AI, data analytics, databases
- Big tech wants you to constantly pay for computing
  - An isolated personal computer on your table doesn’t make them money
- Businesses want to reach their consumers more easily
  - “Every business is a tech business.”
- Surveillance: Everyone wants to track everyone else.

Benefits of cloud computing

- Scalability
  - Computing resources can be scaled up or down as needed
  - Save money by only paying for the resources we use.
- Agility
  - Ability to quickly deploy new applications and services.
- Security
  - More advanced security features to protect data and computation
- Compliance
  - Advanced tools to comply with regulations involving privacy and security
- Cost savings
  - Save money on IT infrastructure costs, such as the cost of buying and maintaining servers, storage, and networking equipment.
- Innovation
  - Provide access to the latest technologies and value added services.

Cloud Service Models

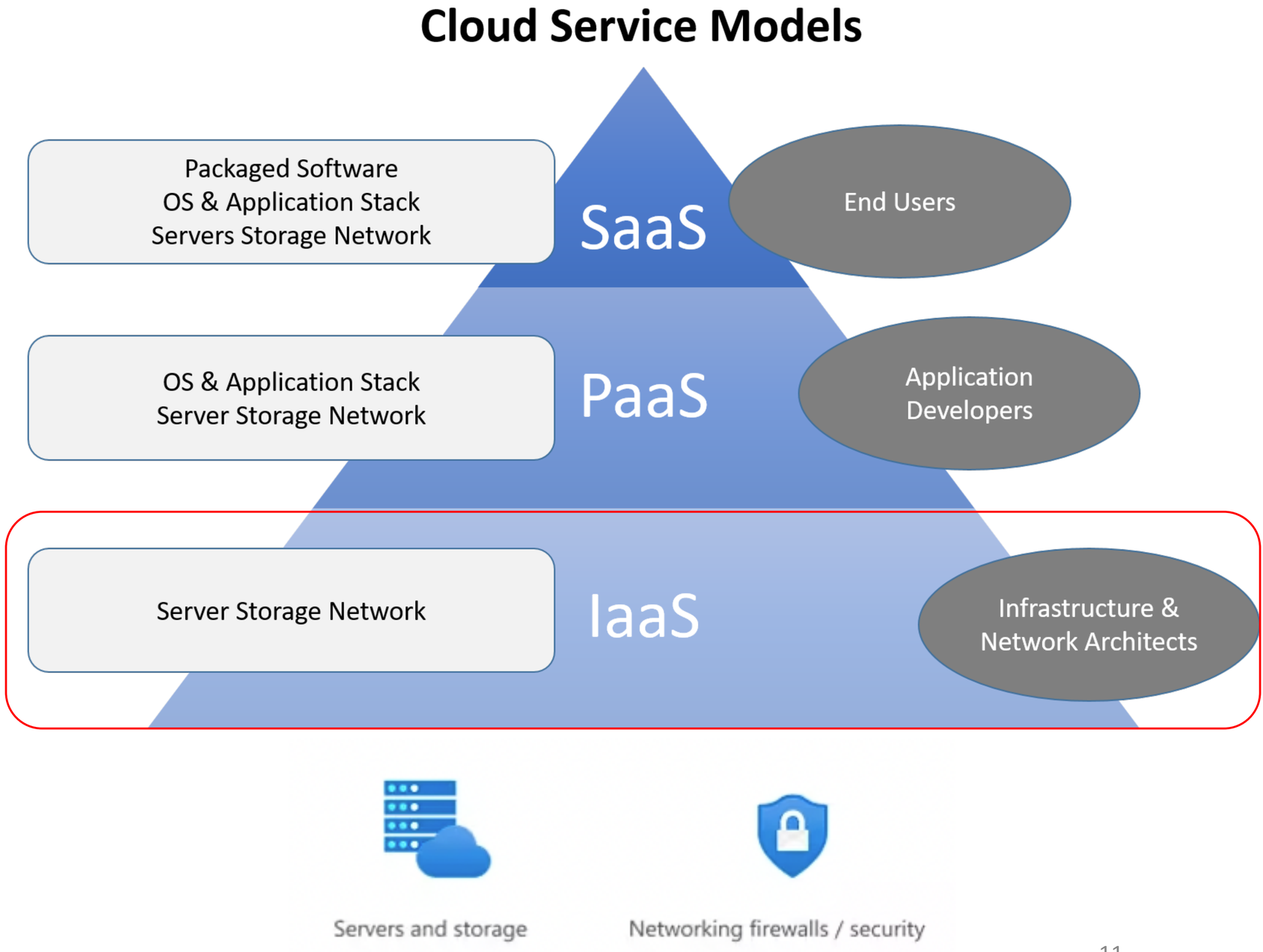


Cloud Service Models

Infrastructure as a Service (IaaS)

- Provides the (virtualized) hardware and usually virtualized OS (VMs) to their customers

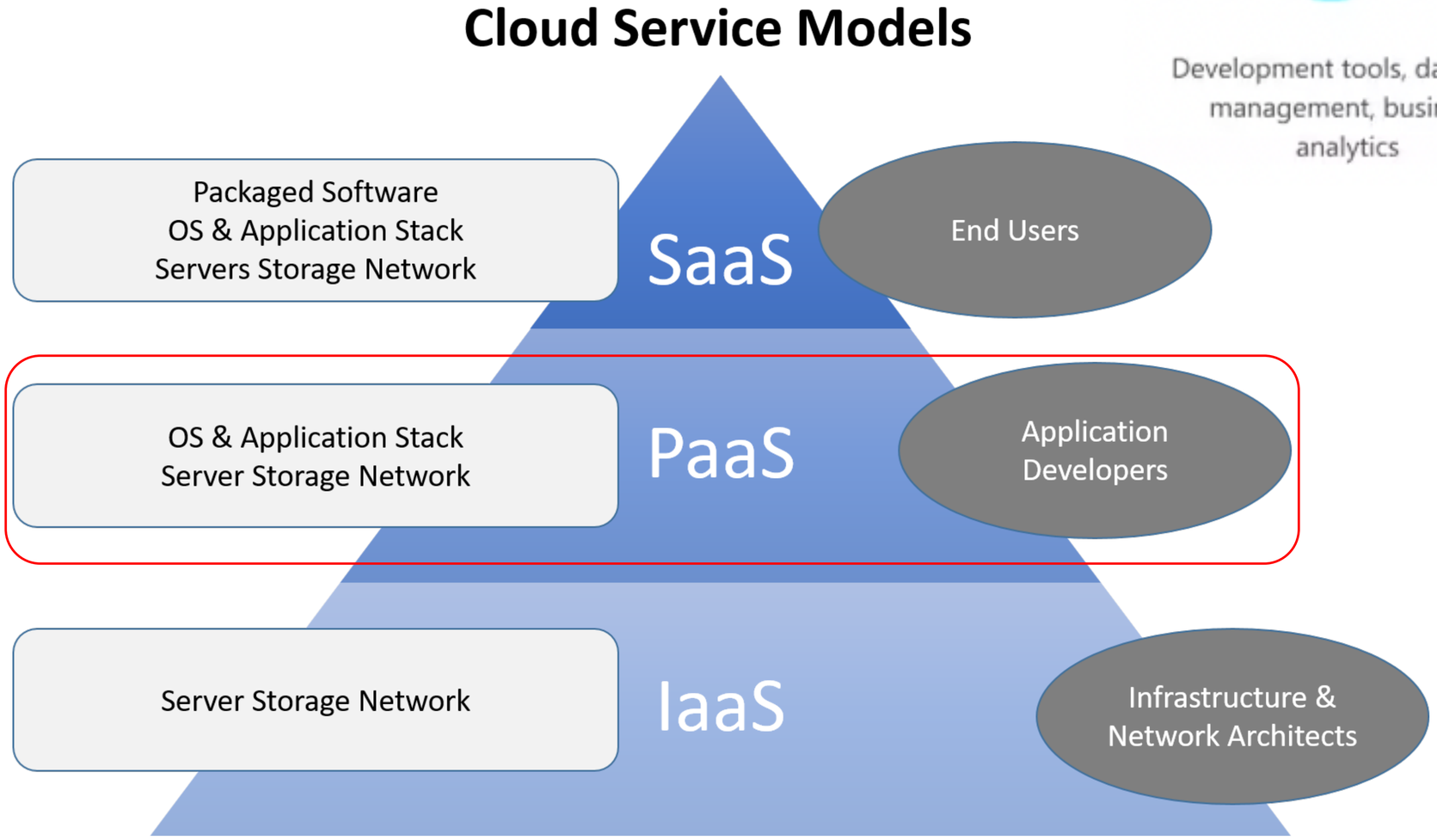
- Examples of IaaS are Amazon EC2, Rackspace, Google Cloud, Microsoft Azure etc.



Cloud Service Models

Platform as a Service (PaaS)

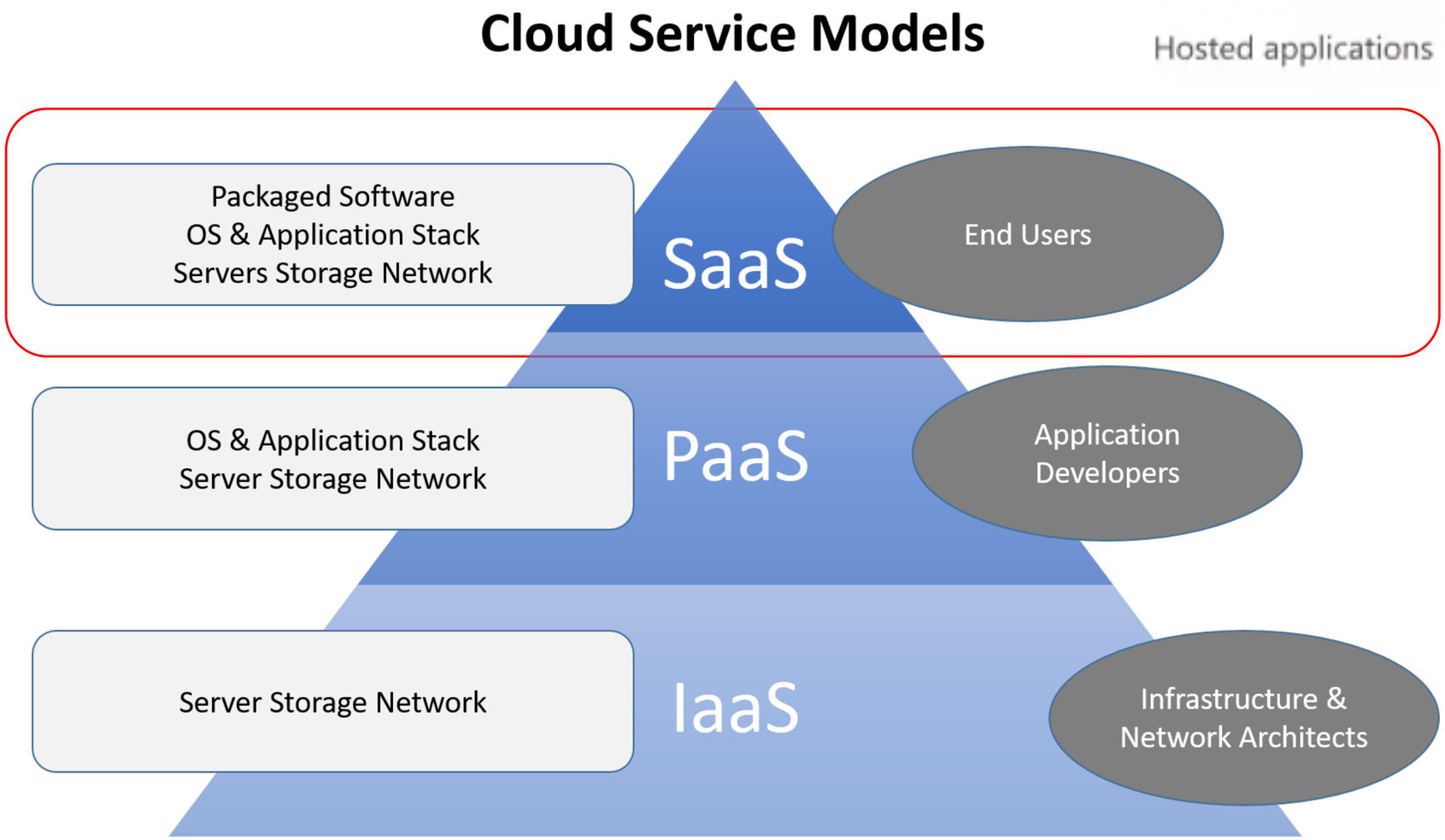
- Support a specific program language or development environments.
- Deploying your app in this environment, you can take advantage of dynamic scalability, automated database backups without needing to code for it.
- Examples are Google App Engine, Amazon's S3, etc



Cloud Service Models

Software as a Service (SaaS)

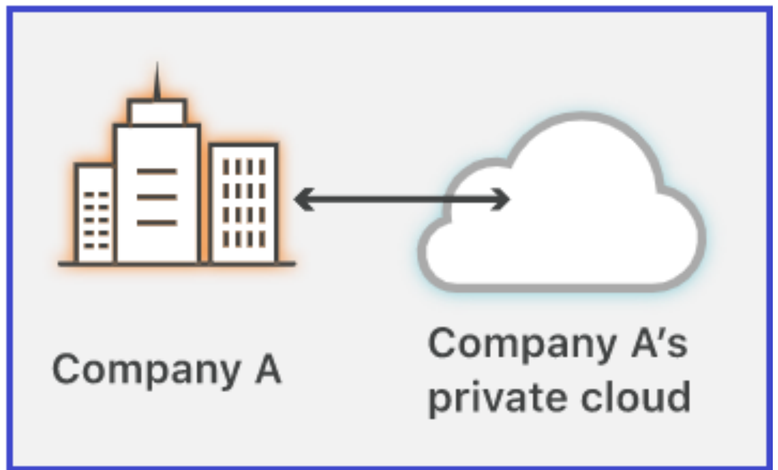
- The data for the app runs on a server on the network
- Software is usually sold via subscription
- Examples of SaaS are Salesforce, Google Docs, Office 365, Basecamp etc.



How is Cloud Deployed?

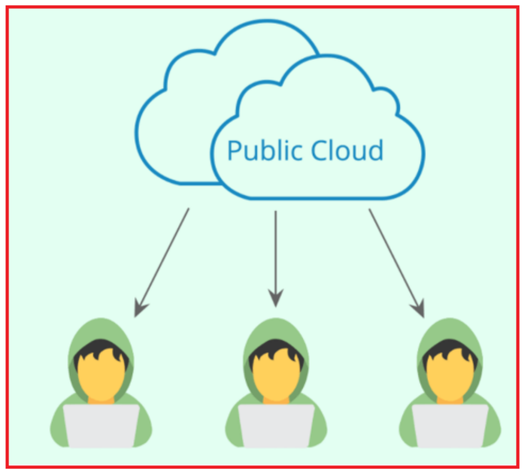
Private cloud

- Single org only,
- Managed by the org or a 3rd party,
- On or off premise



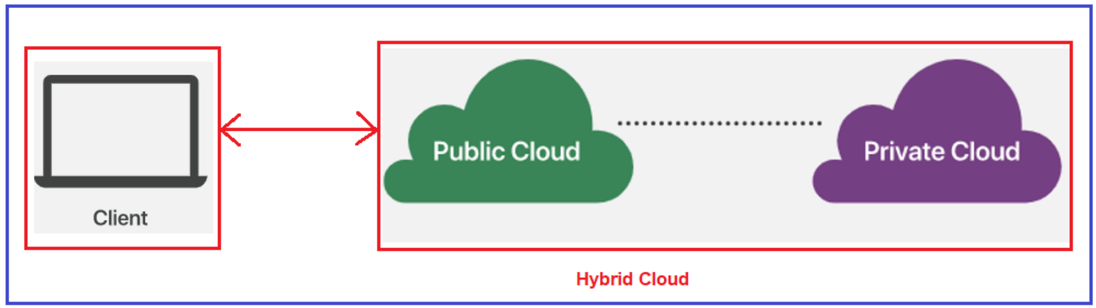
Public cloud

- Sold to the public, mega-scale infrastructure
- Available to the general public



Hybrid cloud

- Combination of two clouds
- Bound by standards or proprietary technology



Prevalence of cloud computing

- Market size $545 billion in 2022 and will grow at CAGR of 17.9% to 2030
- New technologies, like AI and machine learning, and new working mode, such as remote working, will enable cloud growth
- According to Foundry's 2022 report, 41% of companies host most or all IT infrastructure in the cloud.
- Organizations are defaulting to cloud-based services when upgrading or purchasing new technical capabilities.

But where does the cloud “run”?

An example: Microsoft Azure Datacenter Map

What does this Course Cover?

New database technologies (e.g., Object storage and Key-value stores), data analytics systems (e.g., Hadoop and Spark), and IoT

…

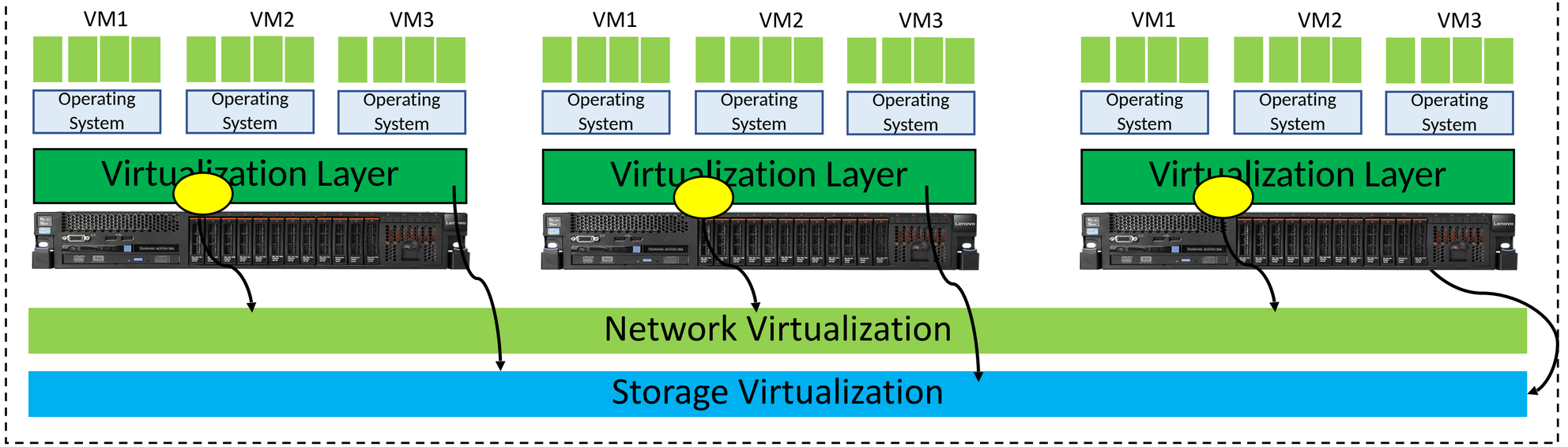
SaaS

New Programming Models, e.g., severless, microservices, and Kubernetes

…

PaaS

Cloud Platforms



IaaS

Summary

- Cloud computing provides a simple way to access servers, storage, databases and a broad set of application services over the Internet

- Benefits of cloud computing
  - Scalability, Agility, Security, Cost savings, Compliance, Innovation

- Cloud computing provides three service models
  - IaaS, PaaS, and SaaS

- There are three way to deploy cloud services
  - Private, public, and hybrid mode