

Who Uses Microservices?

When designing a complex system, there are many different server architectures for a system. Two major categories include:

[Monolithic Architecture]:

[Microservice Architecture]:

Monolithic Architecture	Microservices Architecture

Configuration and Deployment Challenges

One of the most challenging bits of microservices is managing the configuration and deployment of the microservices:

- What is the location of my dependencies?
- How do I quickly update the configuration?

Solution: _____

Every process on every Operating System runs with a number of **environmental variables**.

Command to List All Environment Variables	
Linux:	<code>env</code>
Windows PowerShell:	<code>dir env:</code>

A few common ones:

- **PATH:**
- **HOME (or HOMEPATH):**
- **USER (or USERNAME):**

A few commonly defined in development environments:

- **ENV:**
- **DEBUG:**
- ...any number of custom application-specific ones...

Common Programming Convention: .env Files

A common, but not built-in, programming convention is to use .env files to specify deployment-specific environment variables.

.env file
<code>FLASK_RUN_PORT = 24000</code>

...now, when we run Flask, we see it starts on a different port:

```
$ python3 -m flask run
[... ]
* Running on http://127.0.0.1:24000/ (Press CTRL+C to quit)
```

Networking Ports

Ports provide an application-specific connection allowing multiple services to run simultaneously on a single host.

Port Range:

Common Ports:

Reserved Ports:

Unreserved Ports:

Isolation

Q: Would you let your friend/roommate on your computer?

...system developers share the same concerns. There are many levels of increasing isolation provided by modern infrastructure:

1) Process Isolation

2) User Account Isolation

3) Containerization

4) Virtualization

User Accounts	Containers	Virtualization

User Accounts

Every user of modern systems has a “user account”, with a default “super user account” (called `root` on Linux).

Advantages:

Disadvantages:

Containerization

Containers rely on a “Container Engine” (ex: Docker) that allows apps to interact with the host system in an isolated way.

Advantages:

Disadvantages:

Virtualization

Virtual Machines (VMs) rely on a “Hypervisor” (ex: VMWare) that allows entire operating systems to run on a host system.

Advantages:

Disadvantages:

User Accounts	Containers	Virtualization

Exploration of Different Use Cases:

1) linux.ews.illinois.edu

2) Amazon AWS EC2

	vCPU	ECU	Memory (GiB)	Instance Storage (GB)	Linux/UNIX Usage
t3.nano	2	Variable	0.5 GiB	EBS Only	\$0.0052 per Hour
t3.micro	2	Variable	1 GiB	EBS Only	\$0.0104 per Hour
t3.small	2	Variable	2 GiB	EBS Only	\$0.0208 per Hour
t3.medium	2	Variable	4 GiB	EBS Only	\$0.0416 per Hour
t3.large	2	Variable	8 GiB	EBS Only	\$0.0832 per Hour

3) PrairieLearn

4) Our Class App?