

**Assignment 3:** Identify a real-world application for both parallel computing and networked systems. Explain how these technologies are used and why they are important in that context.

### **Parallel Computing: Weather Forecasting**

#### **Application: Weather Forecasting and Climate Modeling**

##### **How Parallel Computing is Used:**

-----

Weather forecasting and climate modeling involve simulating complex physical processes that govern atmospheric conditions. These simulations require processing vast amounts of data and performing intricate calculations over a large number of variables, such as temperature, pressure, humidity, wind speed, and many others, over a three-dimensional grid that covers the Earth's atmosphere.

##### **Why Parallel Computing is Important:**

-----

**Speed:** Weather models need to produce timely results to be useful. Parallel computing allows these models to run faster by distributing computations across many processors.

**Accuracy:** Higher resolution models, which are more accurate, require more computations. Parallel computing enables running these high-resolution models within a practical time frame.

**Complexity:** Modeling weather patterns and climate change involves solving complex equations that describe fluid dynamics and thermodynamics. These calculations are computationally intensive and benefit greatly from the parallel processing capabilities.

**Example:**

-----

The National Oceanic and Atmospheric Administration (NOAA) uses supercomputers for weather prediction. These supercomputers use thousands of processors working in parallel to perform the trillions of calculations needed for accurate weather forecasting. The Global Forecast System (GFS), one of the key models, uses parallel computing to predict weather conditions worldwide up to two weeks in advance.

## **Networked Systems: Online Banking**

### **Application: Online Banking and Financial Services**

#### **How Networked Systems are used:**

-----

Online banking relies on a network of servers and databases that communicate over the Internet to provide real-time financial services. This includes account management, fund transfers, bill payments, and access to banking products such as loans and investments.

## Why Networked Systems are Important:

-----

**Accessibility:** Networked systems allow customers to access banking services from anywhere in the world at any time, significantly improving convenience and accessibility.

**Real-time Processing:** Transactions such as payments and transfers can be processed in real-time, providing immediate confirmation and reducing delays.

**Security:** Networked systems implement advanced security measures, such as encryption and multi-factor authentication, to protect sensitive financial data.

**Integration:** They enable the integration of various financial services and systems, providing a seamless user experience and comprehensive financial management tools.

## Example:

-----

Banks like JPMorgan Chase and Citibank use extensive networked systems to support their online banking platforms. These systems involve multiple data centers, redundant networks, and robust security protocols to ensure that millions of customers can safely and efficiently conduct transactions, monitor account activities, and manage their finances online.

## Importance in Their Contexts

---

### Weather Forecasting:

Accurate and timely weather forecasts are crucial for agriculture, disaster management, aviation, shipping, and many other sectors. They help in preparing for and mitigating the impacts of severe weather events, thereby saving lives and reducing economic losses.

### Online Banking:

Online banking transforms the way individuals and businesses manage their finances, offering unprecedented convenience and efficiency. It supports the global economy by enabling rapid and secure financial transactions, promoting financial inclusion, and reducing operational costs for banks and customers alike.

- In both cases, the technologies of parallel computing and networked systems enhance performance, reliability, and user experience, demonstrating their critical roles in modern applications.