Assignment 1 of CISC 3018

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C/S service model

$$d_{CS} = max\{\frac{NF}{u_s}, \frac{F}{min_i(d_i)}\}$$

P2P model

$$d_{P2P} = max\{\frac{F}{u_s}, \frac{F}{min_i(d_i)}, \frac{NF}{u_s + \sum u_i}\}$$

1.1

$N = 5$

$$\begin{aligned} d_{CS} =& max\{\frac{NF}{u_s}, \frac{F}{min_i(d_i)}\} \\ =& max\{\frac{5 \times 20MBits}{40MHz}, \frac{20MBits}{10MHz}\} \\ =& \frac{5}{2}Bits/Hz \end{aligned}$$

$N = 10$

$$\begin{aligned} d_{CS} =& max\{\frac{NF}{u_s}, \frac{F}{min_i(d_i)}\} \\ =& max\{\frac{10 \times 20MBits}{40MHz}, \frac{20MBits}{10MHz}\} \\ =& 5Bits/Hz \end{aligned}$$

$N = 20$

$$\begin{aligned} d_{CS} =& max\{\frac{NF}{u_s}, \frac{F}{min_i(d_i)}\} \\ =& max\{\frac{20 \times 20MBits}{40MHz}, \frac{20MBits}{10MHz}\} \\ =& 10Bits/Hz \end{aligned}$$

$N = 40$

$$\begin{aligned} d_{CS} =& max\{\frac{NF}{u_s}, \frac{F}{min_i(d_i)}\} \\ =& max\{\frac{40 \times 20MBits}{40MHz}, \frac{20MBits}{10MHz}\} \\ =& 20Bits/Hz \end{aligned}$$

$N = 60$

$$\begin{aligned} d_{CS} =& max\{\frac{NF}{u_s}, \frac{F}{min_i(d_i)}\} \\ =& max\{\frac{60 \times 20MBits}{40MHz}, \frac{20MBits}{10MHz}\} \\ =& 30Bits/Hz \end{aligned}$$

1.2

$N = 5$

$$\begin{aligned} d_{P2P} =& max\{\frac{F}{u_s}, \frac{F}{min_i(d_i)}, \frac{NF}{u_s + \sum u_i}\} \\ =& max\{\frac{20MBits}{40MHz}, \frac{20MBits}{10MHz}, \frac{5 \times 20MBits}{40MHz + 5 \times 5MHz}\} \\ =& \frac{20}{13}Bits/Hz \end{aligned}$$

$N = 10$

$$\begin{aligned} d_{P2P} =& max\{\frac{F}{u_s}, \frac{F}{min_i(d_i)}, \frac{NF}{u_s + \sum u_i}\} \\ =& max\{\frac{20MBits}{40MHz}, \frac{20MBits}{10MHz}, \frac{10 \times 20MBits}{40MHz + 10 \times 5MHz}\} \\ =& \frac{20}{9}Bits/Hz \end{aligned}$$

$N = 20$

$$\begin{aligned} d_{P2P} =& max\{\frac{F}{u_s}, \frac{F}{min_i(d_i)}, \frac{NF}{u_s + \sum u_i}\} \\ =& max\{\frac{20MBits}{40MHz}, \frac{20MBits}{10MHz}, \frac{20 \times 20MBits}{40MHz + 20 \times 5MHz}\} \\ =& \frac{20}{7} Bits/Hz \end{aligned}$$

$N = 40$

$$\begin{aligned} d_{P2P} =& max\{\frac{F}{u_s}, \frac{F}{min_i(d_i)}, \frac{NF}{u_s + \sum u_i}\} \\ =& max\{\frac{20MBits}{40MHz}, \frac{20MBits}{10MHz}, \frac{40 \times 20MBits}{40MHz + 40 \times 5MHz}\} \\ =& \frac{10}{3} Bits/Hz \end{aligned}$$

$N = 60$

$$\begin{aligned} d_{P2P} =& max\{\frac{F}{u_s}, \frac{F}{min_i(d_i)}, \frac{NF}{u_s + \sum u_i}\} \\ =& max\{\frac{20MBits}{40MHz}, \frac{20MBits}{10MHz}, \frac{60 \times 20MBits}{40MHz + 60 \times 5MHz}\} \\ =& \frac{60}{17} Bits/Hz \end{aligned}$$

1.3

$$\begin{aligned} F =& 20MBits, \\ u_s =& 40MHz, \\ min_i(d_i) =& 10MHz, \\ u_i =& 5Mhz \end{aligned}$$

$$\begin{aligned} d_{CS}(N; F, u_s, d_i, u_i) =& max\{\frac{NF}{u_s}, \frac{F}{min_i(d_i)}\} \\ =& max\{\frac{N \times 20MBits}{40MHz}, \frac{20MBits}{10MHz}\} \\ =& max\{\frac{N}{2}, \frac{1}{2}\} Bits/Hz \\ =& \frac{N}{2} Bits/Hz \end{aligned}$$

$$\begin{aligned} d_{P2P}(N;F,u_s,d_i,u_i) =& max\{\frac{F}{u_s},\frac{F}{min_i(d_i)},\frac{NF}{u_s+\sum u_i}\} \\ =& max\{\frac{20MBits}{40MHz},\frac{20MBits}{10MHz},\frac{N\times 20MBits}{40MHz+N\times 5MHz}\} \\ =& max\{\frac{1}{2},\frac{1}{2},\frac{4N}{8+N}\}Bits/Hz \end{aligned}$$

We can get:

$$\frac{4N}{8+N}-\frac{1}{2}=\frac{3N-8}{16+2n}.$$

When $3N-8>0$, i.e. $N\geq 3>\frac{8}{3}$

$$d_{P2P}(N;F,u_s,d_i,u_i)=\frac{4N}{8+N}Bits/Hz$$

and when $3N-8\leq 0$, i.e. $0\leq N\leq 2<\frac{8}{3}$

$$d_{P2P}(N;F,u_s,d_i,u_i)=\frac{1}{2}Bits/Hz$$

When $N=5,10,20,40,60$,

$$\begin{aligned} \Delta_{CS,P2P}(5) =& \frac{25}{26}Bits/Hz \\ \Delta_{CS,P2P}(10) =& \frac{25}{9}Bits/Hz \\ \Delta_{CS,P2P}(20) =& \frac{50}{7}Bits/Hz \\ \Delta_{CS,P2P}(40) =& \frac{50}{3}Bits/Hz \\ \Delta_{CS,P2P}(60) =& \frac{450}{17}Bits/Hz \end{aligned}$$

We can know that as N becomes larger, the difference between the two will become larger and larger, and the advantages of P2P will become more and more obvious

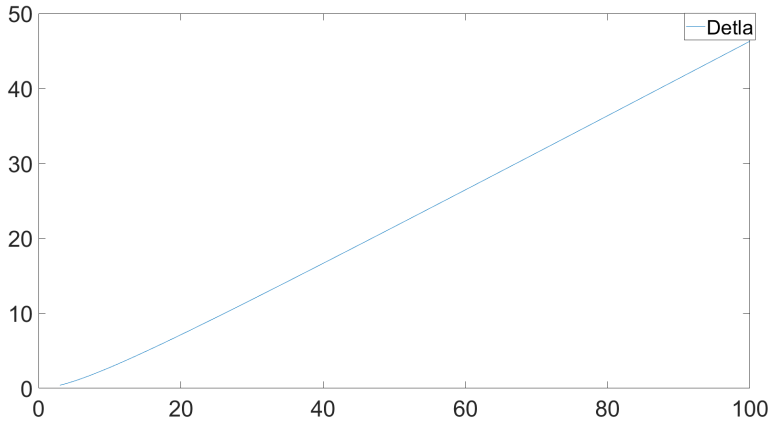
1.4

$$\begin{aligned} \lim_{N\to\infty} d_{CS}(N;F,u_s,d_i,u_i) =& \lim_{N\to\infty}\frac{N}{2}Bits/Hz \\ =& \infty \\ \lim_{N\to\infty} d_{P2P}(N;F,u_s,d_i,u_i) =& \lim_{N\to\infty}\frac{4N}{8+N}Bits/Hz \\ =& \infty \end{aligned}$$

$$\begin{aligned}\lim_{N\to\infty}\frac{d_{P2P}(N;F,u_s,d_i,u_i)}{d_{CS}(N;F,u_s,d_i,u_i)} &= \lim_{N\to\infty}\frac{\frac{4N}{8+N}}{\frac{N}{2}}\\ &= \lim_{N\to\infty}\frac{8}{8+N}\\ &=0\end{aligned}$$

When $N > 3$,

$$\begin{aligned}\Delta_{CS,P2P}(N) =&(\frac{N}{2}-\frac{4N}{8+N})Bits/Hz\\ =&\frac{N^2}{16+2N}Bits/Hz\end{aligned}$$



We can know that as N is infty, both of them will need infty time to finish the distribution, but the difference between the two will become larger and larger, and the advantages of P2P will become more and more obvious

2

'C' means consistency, 'A' means availabilty and 'P' means partition tolerance.

CAP Theorem tell us that a distuributed system can only achieve two out of 'C','A' and 'P'.

A distuributed system can not simulataneously achieve all of them, because when the content in one node change, we need time to sync the content of all nodes. During the synchronization, if we want to

achieve 'C', we should temporarily end of service. This makes us unable to achieve 'A'.

3

Yas

Blockchain work with the consensus mechanism, which is a set of rules that decides on the contributions by the various participants of the blockchain, i.e. consensus algorithm(protocol).

- Proof of Work(PoW)
- Proof of Stake(PoS)
- Practical Byzantine Fault Tolerance(PBFT)

Advantages of PBFT:

- NO minting and faster than PoW and PoS

Disadvantages of PBFT:

- Scalability problem. $Nodes \leq 20$

4

Advantages

- Cost efficiency
- High convenient for deploying new services
- Enhancing accessibility

Disadvantages

- Internet connection dependent
- Additional bandwidth-resource usepackage
- Service reliability
- Privacy issue
- Vendor issue

5

Difference

- Public cloud: everyone can access the network
- Public cloud: User have less control over their data
- Private cloud: users need authorization to access the network
- Private cloud: When and where the user can see the data is controlled

Advantages of Multi-cloud services

- Cost efficient
- Enhanced capabilities in service delivery
- Enhanced availability and reliability

6

Difference between the IaaS. PaaS, and SaaS

- IaaS is providing 'Infrastructure' to customers which means users will driectly control CPUs, storage, networking and other hardwave.
- PaaS is providing 'Platform' to customers which means a deployment environment and users no need to care about system and focue on code, script...
- SaaS is providing 'Software' which means customers use some application that need Cloud to storage, computing and son on.
- VM: Provide a environment to developer that looks like a physical machine.
- Hypervisor: An administrator to control the interaction between the simulataneously renning VMx and resource pool.

VMware use *direct approach* to implement its hypervisor
Advantages of direct approach

- Directly control and manage the resource pool