

OPPORTUNISTIC JOB SHARING FOR MOBILE CLOUD COMPUTING

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ABSTRACT

Cloud Computing is the evolution of new business era which is covered with many of technologies. These technologies are taking advantage of economies of scale and multi tenancy which are used to decrease the cost of information technology resources. Many of the organizations are eager to reduce their computing cost through the means of virtualization. This demand of reducing the computing cost and time has led to the innovation of Cloud Computing. It enhanced computing through improved deployment and infrastructure costs and processing time. Mobile computing & its applications in smart phones enable a new, rich user experience. Due to extreme usage of limited resources in smart phones it creates problems which are battery problems, memory space and CPU. To solve this problem, we propose a dynamic mobile cloud computing architecture framework to use global resources instead of local resources. In this proposed framework the usefulness of job sharing workload at runtime reduces the load at the local client and the dynamic throughput time of the job through Wi-Fi Connectivity.

KEYWORDS

Cloud Computing, Offloading, Cost, Time, Smartphone, Wi-Fi.

1. INTRODUCTION

Cloud Computing technology maintains data and application using central remote server. It permits the user to use these technologies without installing their related files at any computer. At any time resources and applications are available to be used from the cloud via the internet. Cloud technology is the base of new business. Cloud technologies are taking advantage of economies of scale and multi tenancy which are used to decrease the cost of information technology resources. However, data uses a significant and growing portion of energy, an average data consumes as much energy as 30,000 households. The current demand of cloud computing technology is that consumers only use those data which they require, and only pay for what they actually consume. Mobile computing is an interaction between human and computer by which the computer is expected to be transported during usage [4]. It includes mobile hardware, mobile communication and mobile software [4]. The greatest feature of the mobile cloud computing is that it allows the user to connect its relevant data from anywhere in the world via network. Energy-aware computing is crucial for cloud computing systems that consume considerable amounts of energy [5]. Problems occur when trying to support mobility in computing devices: resource sparseness, hazardousness, finite energy source, and low connectivity [5].

In this paper we refer job sharing/scheduling based algorithm so that each connected devices gets their part of work and using offloading process each one can do their work properly & acknowledges to the central server. By using of Service Level Agreement, achieving high[35] performance in cloud computing and of great significance for improving resource load balance, security, reliability and reducing energy consumption of the whole system.[32,35]In this paper we used Wi-Fi as connectivity option. Using Wi-Fi based architectural framework we can utilize all the global resources via network connectivity but not only limited to the local resources. Cloud is available for low end mobile device as well as high end mobile device in this framework. Most of the cloud resource would be mobile, computer, laptop etc. Dynamic mobile cloud framework can handle run time resources and connectivity. In the framework we explain vision towards the process large amount of job which requires huge hardware resources with smart phones by partitioning the task into the number of jobs which is cost-saving, battery-life saving. Using this architectural framework huge task can be done in just a matter of time using global resources.

2. RESEARCH DETAILS

Now days,Cloud Computing is one of the most famous topic and it is play very important role in enterprises due to the cost charges and computational promises it gives. I am doing the study on the issue of “Opportunistic Job Sharing For Mobile Cloud Computing” Opportunistic Job Sharing group is an enterprise which is using Cloud Computing andmy research question are: What are the basicprofits and drawback regarding cost, time and data security by using Wi-Fi technic for Enterprises to adopt Cloud Computing?

2.1 Purpose of Research

Basic fundamental of the thesis is to extract the advantages and drawbacks with respect to cost, time, datasecurity and data availability so organizations can have by the use of Cloud Computing for the implementation of their information system. Finally concluding the factors in terms of cost, time and data security by using Wi-Fi technic, enterprises should keep in mind while adopting CC for the effective and efficient use of their information system.

2.2 Related Work

In this section we provide a review of related research efforts, ranging from the earlier approaches that focus two methods relating to offloading, job scheduling work from mobile.

Marinelli [2] introduce Hyrax, mobile cloud computing technology consumer that agrees mobile devices to utilize cloud computing platforms. Based on Hadoop1, the main focus of this work is to port a client into a mobile device to enable the integration. The author introduces the concept of using mobile devices as resource providers, but further experimentation is not included. [2]

Integration between mobile devices and cloud computing is presented in several previous works. Christensen [1] presents general requirements and key technologies to achieve the goal of mobile cloud computing. The author introduces an exploration on latest smart phones, framework awareness, cloud and restful based web services, and explains how to create this innovative components for a better experience for mobile phone users. [1]

Fernando, W. Loke and WennyRahayu, Introduce the feasibility of a mobile cloud computing framework to use local resources [4]. Main aim of the framework is to determine a usefulness of sharing workload at runtime. The results of experiments conducted with Bluetooth transmission. [4]

RehanSaleem (831015-T132),It Introduce cloud computing's effect on enterprises, theirresearch work is define, How to handle the effects of Cloud Computing in the enterprises. The specific areas he researched during his study were cost and security and specially he give the differences between grid computing and cloud computing, Cloud Computing is the sum of Software as a Service (SaaS) and Utility Computing, but does not include Private Clouds. [6]

PriyankaGupta&PoojaDeshpande, It introduceto Efficient Resource Allocation and Scheduling Approach to Enhance the Performance of Cloud Computing [32].Attempts to schedule the jobs such a way that cloud provider can gain maximum benefit for his service and Quality of Service (QoS) requirement user's job which enhances the performance of cloud service.[32]

2.3 Motivation forthe Work

Let's consider the scenario of Mr Rahul (Photo editor) travelling by car. He suddenly gets an email to edit a large size image. He starts editing. Since the large size image need to be edited only on laptop because it cannot be edited on the smart phones due to memory constraints, limited battery power & low CPU processing of smart phones. As the matter of the fact he cannot edit the image.

In this scenario if he has a dynamic mobile cloud computing framework through this he can create a cloud using network (Wi-Fi) then the result would be different. He uploads image to the central server (cloud) using Wi-Fi network & asks some of his colleagues to do it. All the cloud clients (colleagues) edit the particular part of the image and again send back the response to the server. Central server processes all the responds and again sends back to the Rahul.

In this way Rahul explores the dynamic architectural framework by using sharing/offloading process to complete his job and moved over four major challenges: reduce bulkiness, time-saving, limited memory and battery power. Now John is still available to do any urgent work which is the best part of using this framework.

3. THEORETICAL DETAILS

Main idea of this section is to introduce the framework of my research thesis.

3.1 Cloud Computing

DEFINITION

There are lots of definitions of Cloud Computing giving by different-different researchers. Barkley RAD defines Cloud Computing as [6]:

“Cloud Computing refers to both the applications as services over the Internet and the hardware and systems software in the datacentres that provide those services. The services themselves have long been referred to as Software as a Service (SaaS). The datacentre hardware and software is what we will call a Cloud. When a Cloud is made available in a pay-as-you-go manner to the general public, we call it a Public Cloud; the service being sold is Utility Computing. We use the term Private Cloud to refer to internal datacentres of a business or other organization, not made available to the general public. Thus, Cloud Computing is the sum of SaaS and Utility Computing, but does not include Private Clouds. People can be users or providers of SaaS, or users or providers of Utility Computing.”[6]

Cloud Computing is a new adding pattern. Infrastructure resources (hardware, storage and system software) and applications are provided in as-a-Service manner. When these services are offered by an independent provider or to external customers, Cloud Computing is basically based on fundamental of paid-per-use concept. Main features of Clouds are virtualization and dynamic scalability on demand. Utility computing technology and software as a services are provided in a combined style, whereas utility computing might be consumed separately. Cloud services are used up either via Web browser or Application programming interface. [33]

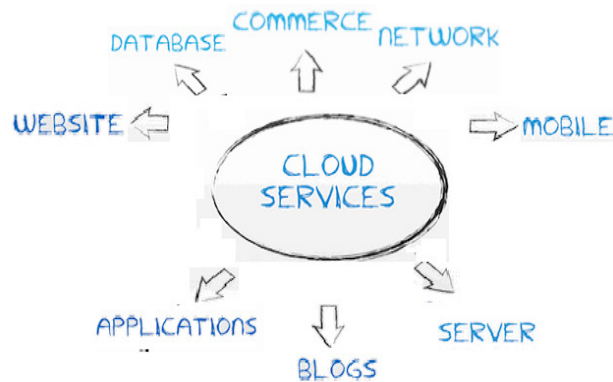


Figure 1. Cloud Services and Applications

3.2 Cloud Service Models

There are 3 Cloud Services Models which are explain below

- Cloud Software as Service: - It is also known as “On demand Software” and it is a software licensing and it provide the software to consumer on subscription base.
- Cloud Platform as Service:-In this type of service, the consumer can deploy, the user generated or developed applications which is create by using programming or tools given by provider, on the cloud infrastructure.[6]
- Cloud Infrastructure as Service: - This is a capability provided to the consumer by which, it can provision processing, storage, networks and other fundamental computing resources where the consumers can deploy and run the software.

3.3 Cloud Deployment Models

- Public Cloud:-This public cloud is available for every organization.
- Private Cloud:-This cloud is available only for particular organization or company.
- Community Cloud: - In this type of cloud deployment model, the infrastructure of the cloud system is commonly used by many of the organizations and supports a specific community with shared concerns.
- Hybrid Cloud:-It is a composition of two or more different clouds that is private or community or public. Element of the hybrid cloud are tightly coupled.

4. PROPOSED ARCHITECTURE

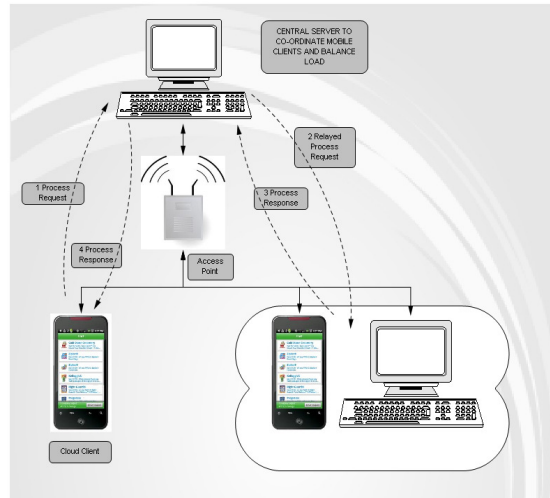


Figure 2. Main component of a cloud framework

The three main components of the architectural framework are cloud client, central server and ad-hoc network.

CLOUD CLIENT

It's like a master component of the cloud. This client sends request to the central server. SOAP protocol is used as communicating medium among the connected devices. This is the master user as this controls the all the query. It offloads all it works to the central server.

SOAP sender: Cloud Client

CENTRAL SERVER/Resource Manager

It is the heart of the architecture. It gets all the SOAP requests from the master that is cloud client and converts into XML language. This server uses basic job sharing algorithm for distribute the job & intimidate to the other cloud connected devices according to their resource and capabilities. It acts as a resource manager.

SOAP message path: Central Server

AD-HOC NETWORK/Job Handler

It is the bunch of connected devices which is responsible for the load balance. These are kind of slave devices who acts on getting the SOAP request from the server. Whole devices share the same cloud and every device gets the SOAP request from the central server depending on the size of task from the master cloud client. Once the jobs have been distributed, the clients would proceed to execute their job/s. When the job handler (client) devices finish their job, result are sent back to the master and reassembled.

SOAP receiver: Ad-hoc network

5. PROPOSED WORK AND IMPLEMENTATION

5.1 Basic Architecture

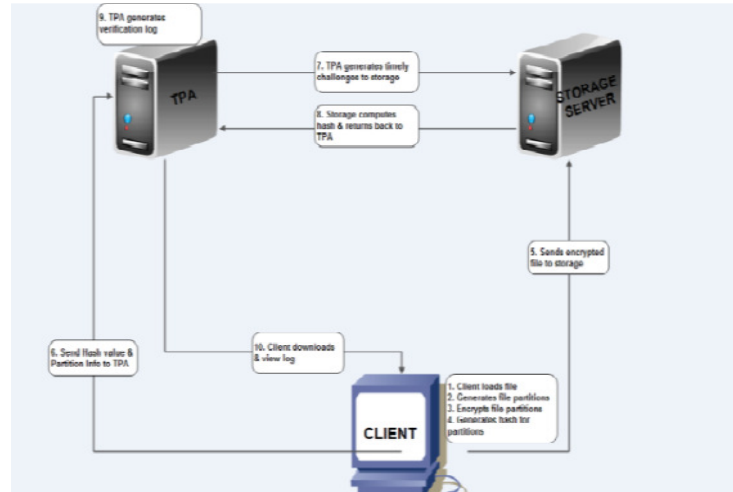


Figure 3. Basic Architecture

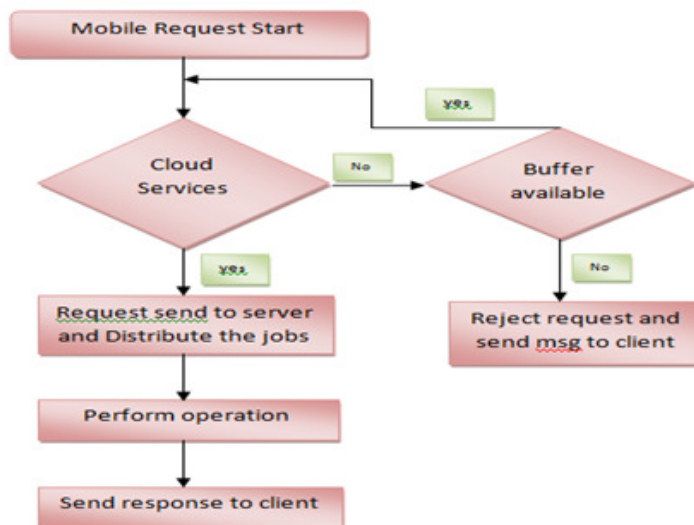


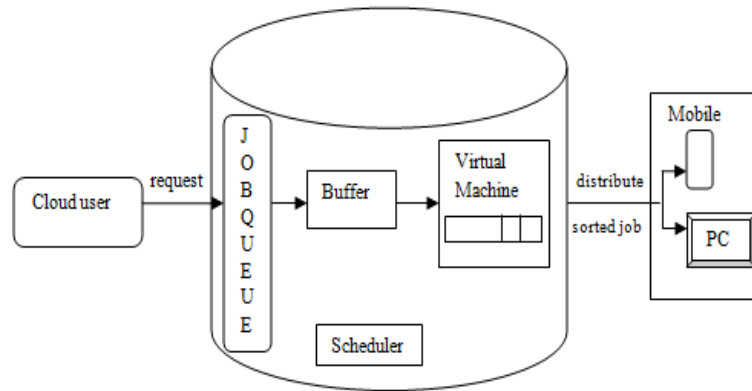
Figure 4. Flow Diagram of Cloud request and response

5.2 Process of Cloud Request and Response

Mobile user send the request to the cloud server, it passes through many step until acceptance and run or rejected. This process is shown in figure 4. As can be seen in figure 4, Cloud users (Job submitter) send the request to the cloud server to distribute or schedule the jobs according to their cost and availability time of volunteers (Job processor) and after they send the response to cloud user through cloud servers. This entire step is described in the following:

- Request send to cloud server
- Waiting in buffers
- Reject the request because buffer is full or inapplicable
- Accept the request to server and distribute/scheduled the job
- Perform operation by job processor
- Send response to client

5.3 Job Scheduling



Proposed Algorithm described as follows:

- Step 1: Cloud user send job request to the server.
- Step2: Job request will be store in the JOB QUEUE according to their occurrence time.
- Step 3: Select the ready job from the JOB QUEUE and put into BUFFER the job according.
- Step 4: Place this job into VIRTUALE MACHINE and process the job according to the FCFS (First Come First Serve) algorithm method.
- Step 5: Scheduler distribute the sorted list according to the mobile client and balance loader and send to the Resource pool.
- Step 6: Repeat Step 3 to 5 for next set of job.

5.4 Image Processing:-

Image processing is a form of signal processing for which the input is an image, the output of image processing may be either an image or a set of characteristics or parameters related to the image. Image processing is a process to convert an non edited image into more clear image through converting into digital signals in order to get more detailed image or to apply some more effects on it .The purpose of image processing are image sharpening, restoration , visualization ,image recognition etc.

5.4.1 Gray Scale

Gray-scale images represent data per element in a shade of gray that ranges in intensity from zero (being black) to a maximum (being white) with various shades [13]. For example, an 8-bit gray scale will range from 0 to 255, providing 256 different possible levels of brightness. [13]

5.4.2 Conversion to Gray Scale

There are many methods to define how to get a gray-scale image according to the user format. The majority of colour images are stored in RGB (red, green, blue), and are combined to form the final image. A common conversion to gray scale is to take an average of the three values. However, a weighted average of these three values is more appropriate to form a gray intensity that preserves the relative brightness for the sum of the three colour components according to the human vision system. [13-16]

$$V = 0.3R + 0.59G + 0.11B \quad (1)$$

5.4.3 Gray Level Transformation Functions

To define a function that maps a gray level in the input image to a gray level in the output image. This is called a Gray Level Transformation function, and it looks like this: [15]

$$s = T(r) \quad (2)$$

Where r and s represent a certain gray level, and it is defined between 0 and 1. Eq (2) is applied to every pixel on the image. These functions can be used for contrast enhancement, contrast stretching, or thresholding. There is some inverse function that exists that will return the original data. [13-16]



Figure 5. Gray Scale

5.5 Implementation and Result

In my thesis, I am taking an Image as a job to convert into gray image, which is distributed or scheduled according to their time and cost to number of Job processor (Mobile users, Computer user and Laptop users). All are connected to the Cloud server by using Wi-Fi connection. They process the job and convert the image into Gray scale image by using formula (1).

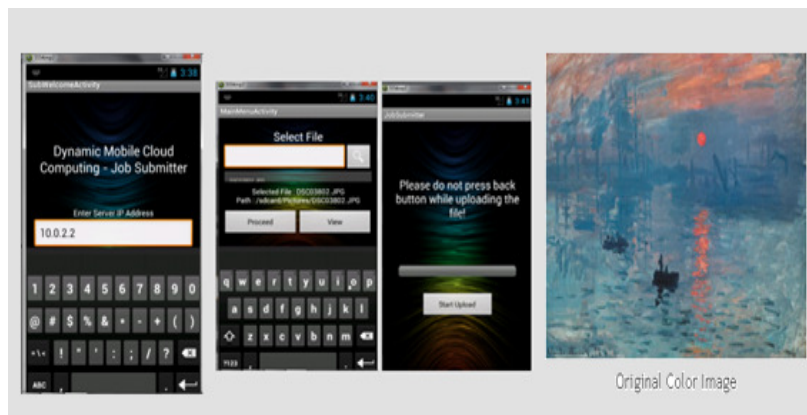


Figure 6. Job Submitting Process

Step: 1 Job submitter connect via Wi-Fi to cloud server by using IP address of Server.

Step: 2 Job Submitter browse the original picture and submit and upload into server show in figure [7].

Step: 3 When upload image to the server, it start to scheduling or distribute the jobs to Job Processor according their time n cost.

Step: 4 Job Processors connect to cloud server and it will get jobs according their cost and time performance show in figure [8].

Step: 5 All Job Processor start to convert original image into gray image, least cost get highest jobs show in fig [8]



Figure 7. Job Processor Process

Step 6: Send the response with grey image to Job submitter.

Step 7: Job Processor get money according the jobs count and cost

Job highest Priority sequence will be shown as below:-

$Cost\ 1 > Cost\ 2 > Cost\ 3$
(*coz cost 1 take least amount compare to cost 2 and cost 3)

Advantage of the system

- MORE RELIABLE
- LOW COST RESOURCE
- LESS EXECUTION TIME

6. SIMULATION OF INSTRUMENT

In simulation with Cloud Analyst tools, there are two main components which are introduced below. Two phones are Samsung Star Pro S7262, Samsung Galaxy Grand Neo Gti9060 and a PC were used in experiments. These three devices were used since they represent a range (low end mobile, high end mobile, resource rich PC) of devices. The PC used had Microsoft Windows 8 Enterprise with Intel(R) Core(TM) Duo CPUE7300 @ 2.66 GHz 2.67 GHz as processor, hard disk 20GB[64 bit] 2 GB RAM and requires a display adapter and a Wi-Fi adapter that supports Wi-Fi Direct. Other details describe in below table

Platform	Android	Windows	Blackberry
Memory	1024	1024	1024
Software Used	Google Drive	One Drive	Box.com
OS version	4.4.3 Kitkat	Windows 8.1	10.2 BB OS
Architecture	X86_64	x86_64	X86_64
Cost	0.0003 \$ per hour	0.0004 \$ per hour	0.00035 \$ per hour

Table 1.Mobile Client

VM vendor	Citrix Technology	VMware	XEN SUSE
Memory	1024	1024	1024
#Number of VM	5	5	5
#Guest OS client	Windows	Linux	SLES 11 sp3
Architecture	X86_64	x86_64	X86_64
Cost	0.2 \$ per hour	0.4 \$ per hour	0.1 \$ per hour

Table 2.Server Specification

Scenario1:-We had an experiment of our implementation of our software. We used Go daddy specification for testing on cloud computing. We took four kind of server configuration from the vendor

- VMware Based: - We configured five VM on it with 1GB RAM and different OS on all the VM for checking the cloud computing traffic.
- Citrix server:-We configured same five OS on xen server also but we found out that xencitrix is easy for mobile traffic also.

Observations: - When we start the job from client as laptop and pc then we were having good job scheduler. We are getting good response time and as well as processing time. We were doing on all the five VM simultaneously for the traffic generations we used standard tool IOMETER_1.1. We generated both kind of random as well as sequential jobs for the server.

Scenario2:-We noticed that we are getting very good performance with PC and laptop clients. Then we thought why not we are merging the code for the mobile also. Right now all the enterprise are using different kind of job scheduler software for the mobile traffic and laptop traffic. So we merged the code to see how the code will perform having laptop and mobile traffic simultaneously. We configured 10 VM (virtual machine) for the test configuration. Then we observed that processing time and response were little bit on higher side but when we configured 10 Data Centres then we are getting approximate same values as were getting before.Please find the comparative data for the above test below:-

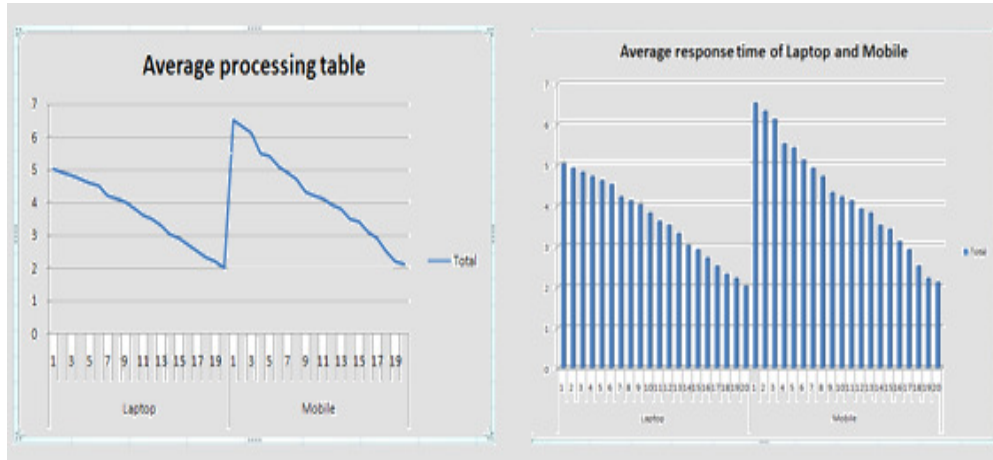


Figure 8 Average processing time

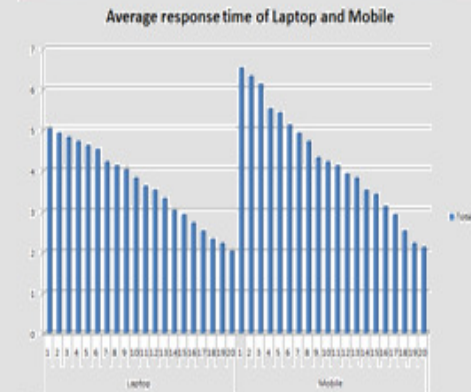


Figure 9 Average response of laptop and mobile

7. CONCLUSION

The concept of cloud computing and job sharing over cloud provides a brand new opportunity for the development of mobile applications that can get heavy tasks done over cloud by offloading computation tasks on cloud, it allows smart mobile devices to retain a small layer for consumer applications and change the processing overhead to the virtual situation. Using the proposed framework the usefulness of job sharing workload at runtime reduces the load at the local client and the dynamic throughput time of the job through Wi-Fi Connectivity instead of the Bluetooth.

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