IEESE International Journal of Science and Technology (IJSTE), Vol. 11 No. 1, March 2022, 6-16
ISSN : 2252-5297

Increasing Users Response of Tourism Game

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Abstract. Not all information about tourist attractions is described and displayed properly, especially those related to transactions between parties at tourist sites, such as with tour guides, ticket providers and other parties at tourist sites. The appearance is very important because tourists need knowledge of the activities that will be carried out at tourist sites as a consideration to determine the choice of tourist destinations. To solve this problem, it takes the development of alternative media with an attractive look so that tourists can be interested and better know the information displayed, especially coupled with blockchain transactions. Ethereum is one of the blockchain transactions.
In this study conducted a test of Ethereum transactions and had a faster transaction speed than Bitcoin. Ethereum has an average speed of 3.8 seconds per transaction with gas price 30 Gwei, while bitcoin has an average speed of 7 minutes per transaction with the same Gas Price. Test the effectiveness of the blockChain-based transaction system in the stone city tourism simulation game is effective with an effectiveness rate of 100%.

Key Words: *serious game, tourism, blockchain, ethereum*

1. Introduction

The development of tourism in Indonesia is promising, especially for tourist business people and tourist users. There are many tourist attractions in Indoensia spread throughout the region in Indonesia. Batu Malang City is an interesting tourist destination because of its natural beauty. There are many tourist attractions scattered in the city of Batu such as: Jatim Park 1, 2 and 3, Songgoriti, Batu Night Spectacular (BNS) and many other attractions.

There are 3 phases in travel, namely before the trip, during the trip and after the trip [1]. The phase before the trip is very important because in this phase tourists plan a tourist trip that will be done. In this phase, tourists do data tracking and dig up information before determining the tourist destination to be chosen. Along with the development of science and technology today makes it easy for tourists to track information about tourist destinations both through websites and other social media [2].

Contributions from this study are:
1. Generate a tourist transaction game scenario.
2. Generate a transaction system model on tourist games using Ethereum blockChain.
3. Obtain a response level of understanding of the player's understanding to the visual display of transaction knowledge in the game.

2. Background

There are several studies on various media as information providers for travelers including, mobile applications [3], web [4], games [5] and augmented reality [6]. From some research on the game is very interesting to be developed into a medium of learning, simulation and visual information display. One of them is Serious Game.
Serious games are a genre of games that are suitable for use as a medium of learning and visual appearance because they have elements of Teaching, learning, training, which are registered in the environment and entertainment [7] [8]. This research uses serious games to simulate and visually display the process of tourist transactions so that tourists are interested and easily understand the transaction activities.
To support the development of serious game-based transaction systems, researchers created an architecture by utilizing blockchain technology. In some studies by utilizing blockChain has been successfully used in crypto currencies transaction systems on Bitcoin [9], autonomous transactions for IoT-based e-commerce [10], medical data sharing [11]. BlockChain technology is a technology

platform by utilizing network architecture decentralization [12]. He has an advantage compared to other commonly used architectures, namely centralization. By using a decentralized architecture, each node in the network is connected to each other, so that to carry out data transmission between nodes there is no need to go through the middle node [13]. In addition to having a decentralized architecture, blockChain has distributed data sharing characteristics and has a better level of security [14]. So that through this research, the advantages of blockChain technology can improve the performance of transaction systems in serious tourist games.

As a supporter of blockChain technology, the Ethereum Platform is collaborated in-game using the game's Unity 3D engine. This platform has a Smart Contract feature where it can be used to manage transactions in regulating economic value in games [15]. To implement the architecture of blockchain-based multiplayer transaction system, it is necessary to build a serious game with the aim of East Java Tourism, especially the Batu City area.

This game has characters that can be used by users in transacting between users. Then testing is carried out to obtain information on the usability and level of understanding of players after running the game and the speed of the process and transaction costs between players with four input variables, namely gas price, gas limit, used gas, and data size.

3. Blockchain Transaction Processing

BlockChain is a decentralized method of distributing and storing data consisting of interconnected nodes on the BlockChain network. Inside the blockChain system there is a record of block-shaped data transactions that are connected so as to form a Chain Block. BlockChain is also a distributed database and keeps a record of all transactions recorded in the blockChain network. Transactions are defined based on the time of the process and converted into a Block where each Block is identified by its cryptographic Hash. The block is formed into a linear sequence on each Hash reference Block from the previous Block, forming a Chain Block called BlockChain. BlockChain is managed to be composed of many nodes and each node can execute as well as record the same transaction results [30].

The advantage of the Ethereum BlockChain Framework is that it has an automatic deal rule called a smart contract, where everyone can manage their own transactions they want. For example, the system will send a number of tokens entered with the desired condition as the smart contract settings are met. The use that is proof of smart contracts is special tokens and crowdsales. Crowdsales are also referred to as token sales, initial coin offerings, or ICOs. Escrow smart contracts have become popular for token transfers between untrusted parties. Where a seller can give control of the token to the smart contract, and the token is sent to the buyer when the buyer sends ether to the contract. Other digital assets other than tokens can be stored using smart contracts as well. The company has built contracts to make stocks, real estate, gold, U.S. dollars, and many other assets available and tradable on BlockChain Ethereum [30].

Transactions send ether, deploy Smart Contracts, or perform functions on existing Smart Contracts. Transactions consume Gas, an Ethereum unit of measurement that determines the complexity and cost of the code's operating network. Gas costs from a transaction are used to calculate transaction costs. The transaction fee is paid by the address that sends the transaction to the miner who mines the Block. Transactions can contain optional data fields. For contract deployment transactions, data is the key code of the contract. For transactions sent to a Smart Contract, the data contains the name and argument for performing the function [30].

Ethereum is one of the blockchain platforms that can be programmed with a peer to peer network where each node stores the same copy of the BlockChain database. Next the system runs the Ethereum virtual machine to maintain and change its state. The Ethereum Virtual Machine (EVM) is a virtual machine designed to be run by all participants in a peer to peer network. In addition, EVM can also read and write to BlockChain both code and data that can be run. Then the digital sign verification process is carried out so that EVM is able to run the code completely. The system runs the code when it receives a message verified by the digital sign, and the information stored in BlockChain says that it is worth it. EVM is a large decentralized super computer with millions of accounts at its disposal. The account can be viewed as an object that has the capacity to handle databases, run contract codes and can communicate with other accounts. In addition, smart

contracts can also be considered as accounts. Private keys are used to handle externally owned accounts, where the owner of this private key has full privileges to make transactions and send ether using EOA [30]. An illustration of the Ethereum transaction process can be found in figure 1.

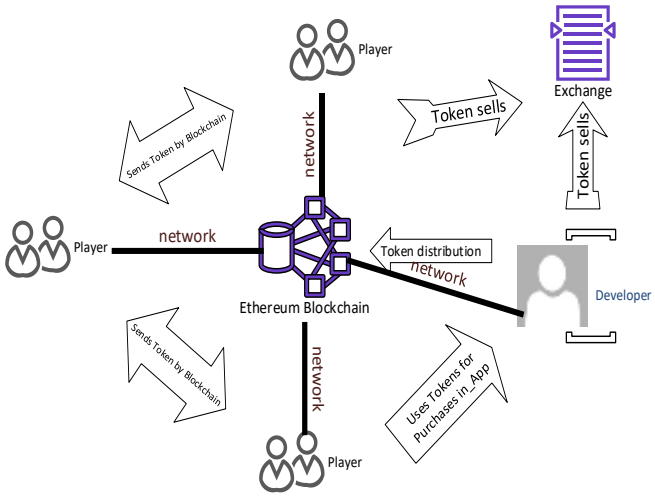


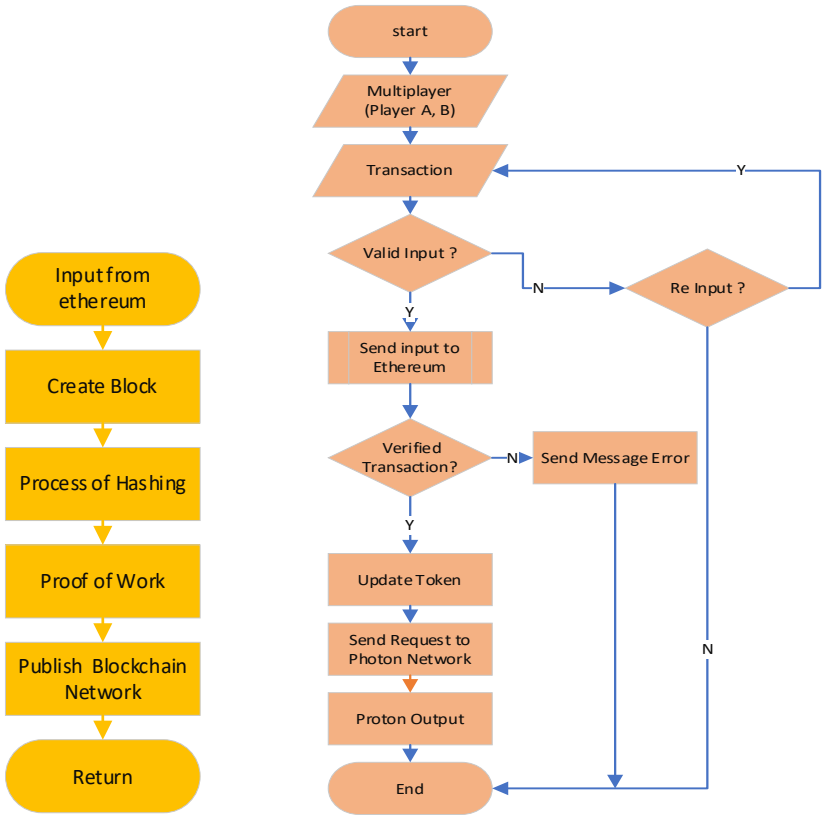
Fig. 1: Illustration of ethereum transaction flow

4. Game Development

In this study, prospective tourists as players run games using devices such as smartphones, ipads, laptops or computers. Inside the device is created game visualization using the Unity3D game engine. To build 3D assets used Blender3D software. To build a transaction system based on ethereum blockChain, Visual Studio is used as a Script Editor, and metamask as a blockChain wallet dashboard. The software has an open source nature, the user interface is easy to understand. This study used the ethereum blockChain network that connects each player's device to interact with each other.

In this research design, players who have registered and entered the Gameplay can explore all the maps that have been available in the Game. Furthermore, players can also make transactions with other players with the transaction feature. Players can buy and sell services with other players. Transactions on this study were processed with the Ethereum BlockChain platform.
BlockChain's decentralized system allows Players and Developers to use a better economic system compared to a centralization system. Where the control of the centralization system is fully held by the Developer and only a few transaction features can be accessed by the Player. In centralization systems, services are not fully owned by players, and developers can easily withdraw or remove services owned by players on this system. The concept is different from the decentralized system, where every service can be fully owned. In addition, this system can allow for complete control over the assets owned by players. Players can also sell their assets to earn Ether currency. The currency can also be used for other purposes inside or outside the game. Service ownership in this concept cannot be changed or removed even by developers, it is because decentralized systems have a better level of security. Therefore, by using a decentralized system, it is also expected that it will increase the credibility of players when running the tourist games developed in this study.

In the transaction process between players, some input data is obtained from the player who made the transaction. Where each transaction data results contain the player's identity, transaction type, number of tokens used. The data will be used as inputs that will be processed by Ethereum for input validation. If the input is correct, it will be continued by the Photon network to process the output. For the visualization of the flow is explained through figure 2.



Gambar 2. Architecture System

When the player performs the transaction process in the game, there is some data ready to be transmitted. The data includes the identity of the player, the type of transaction and the number of tokens used. The system uses such data as input processed by ethereum for the purpose of verification. After the data is verified, the Photon network processes it so that it produces photon process output.

In the ethereum blockChain-based transaction system, each data input goes through several processes, including creating blocks, hashing, Proof-of-Work validation to broadcast blocks to blockchain networks. Figure 3 shows in detail each step of the transaction process. The first process in sending input data to ethereum is to enter data into the block, including the type of transaction, the value sent, the purpose of the transaction, gas limit, private key account. After the data is entered into the Block, the system performs the Hashing process using the keccak256 algorithm. In the Hashing process, it will be checked whether the amount of computation exceeds the limit gas value previously entered in the unity3D code line. If the computational value exceeds the specified gas limit, then the system stops the process. If the computation performed has not exceeded the gas limit value, the system proceeds to the Proof of Work process. In the Proof of Work process, the system validates the Hash value. If the Hash value still does not reach the target, the system performs a pseudo random increment process and repeats the Hashing process until the Hash value reaches the desired target. After the target is reached, the Proof-of-Work process is continued for input data validation. If the entered data is invalid, then the process is stopped and the program sends a message to the system, in the form of error details. If it is the other way around then the system resumes the block publication process to the BlockChain network.

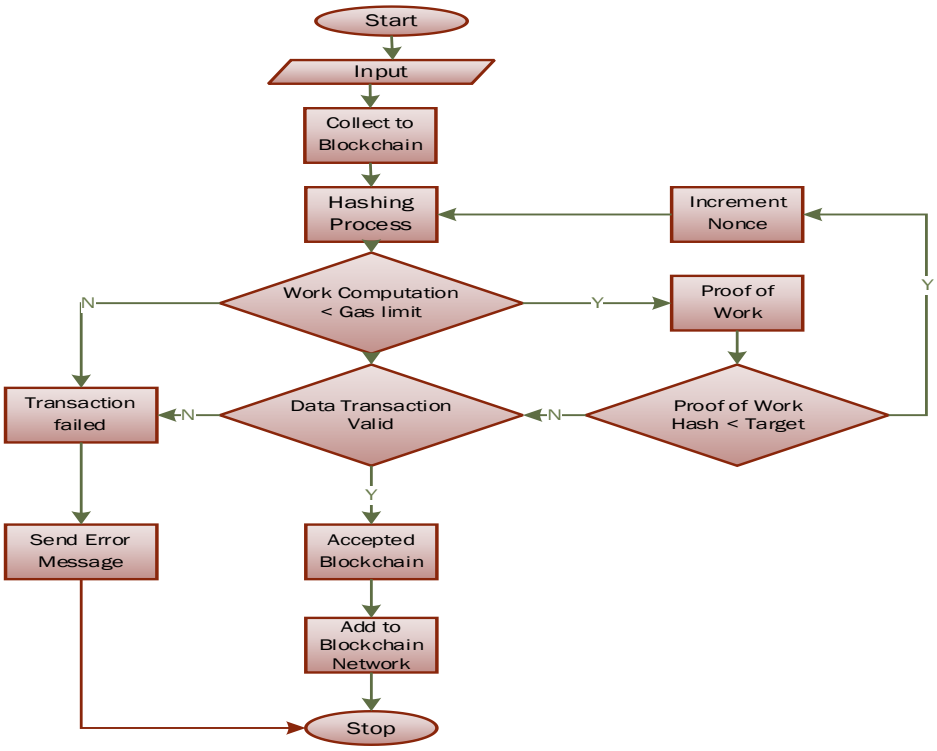


Fig. 3. Validation Proof of Work

5. System Testing and Analysis

5.1. Development Cost and Estimation Testing

This testing process is carried out by calculating the cost per transaction and then compared with other platforms. Transaction costs on the Ethereum Platform depend on the amount of Gas used at the time of mining, the more Gas used, the greater the cost needed, for the measurement of costs incurred by each transaction can be calculated by the following calculations.

$$\text{Gas Price}_{\text{Transaction}} = \text{Gas Used} \times \text{Gas Price} \quad (1)$$

Definition :
Gas Used : the amount of gas used for computing.
Gas Price : fees that must be spent on each gas used.
Gas Price$_{Transaction}$: fees to be paid for the transaction process.

The formula used by the Ethereum Platform to calculate transaction costs is the same as the Bitcoin Platform, which distinguishes the two Platforms is the cost that must be incurred to process transactions. For the graphic data in figure 4.

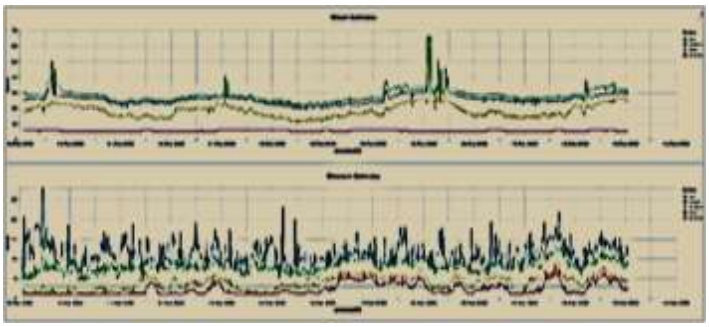


Fig. 4 Graphic of estimated transaction costs in currency (GWEI)

In figure 4, you can see the cost required to process a transaction. If the cost is on average, the cost is as follows.

In transactions, Bitcoin and Ethereum have several prediction packages that affect the speed of prediction, including Fastest, Fast, Medium, and Slow. Table 1 shows that in some of the same plans, Ethereum always has cheaper transaction fees.

Table 1. Average transaction fee data for 10 days.

	Bitcoin Fees	***Ethereum Fees***
Fastest	-	11.19
fast	32.876	8.38
Medium	27.649	5.32
Slow	19.426	3.2

In transactions, Bitcoin and Ethereum have several prediction packages that affect the speed of prediction, including Fastest, Fast, Medium, and Slow. Table 1 shows that in some of the same plans, Ethereum always has cheaper transaction fees.

Several method options are devoted to different traders with developers. In developers, they can program their own desired Gas Price value, Gas Limit, data weight, and smart contract. In this study, to find the cheapest price has been conducted several experiments by regulating the value of Gas Price, Gas Limit, data weight, and Smart Contract.

5.2. Gas Limit Testing

In Table 2, we can see the time needed for the transaction process based on the costs we offer miners, but in the data above is the Cost data that we offer for each Gas used for the mining process, while in each transaction has different gases based on weight, difficulty, and how many blocks are already on the network. This requires that each new transaction must have a unique Hash value and should not be the same as the previous Hash value. Therefore, the more block spread in the network, it will also cause the gas needed for the mining process to also increase, therefore developers must also think of strategies so that spending on transaction systems can be as small as possible, but have the ideal speed. In the study, a test was also conducted on Gas Limit so that transaction fees in Batu tourist games could be controlled and not soar beyond the estimated Development Cost. Gas Limit testing data can be seen in table 2.

Table 2. Testing Transactions With Different Gas Limits

Gas Limit	**40.000**		***Gas Limit***	**50.000**		***Gas Limit***	**60.000**
experiment	Information		experiment	Information		experiment	Information
1	success		1	success		1	success
2	success		2	success		2	success
3	success		3	success		3	success
4	failed		4	success		4	success
5	failed		5	success		5	success
6	failed		6	success		6	success
7	failed		7	failed		7	success

8	failed		8	failed		8	success
9	success		9	success		9	success
10	failed		10	success		10	success

In table 2 it can be seen that the Gas Limit with a variable of 60,000 is successful in each transaction experiment. In these results, it becomes the standard Gas Limit used in batu tourist games.

5.3. Tourism Game Application

Batu tour game application program runs on the windows platform using the Unity engine, as for the display of select characters can be seen in figure 5, the display of the choice of tourist characters in figure 6.

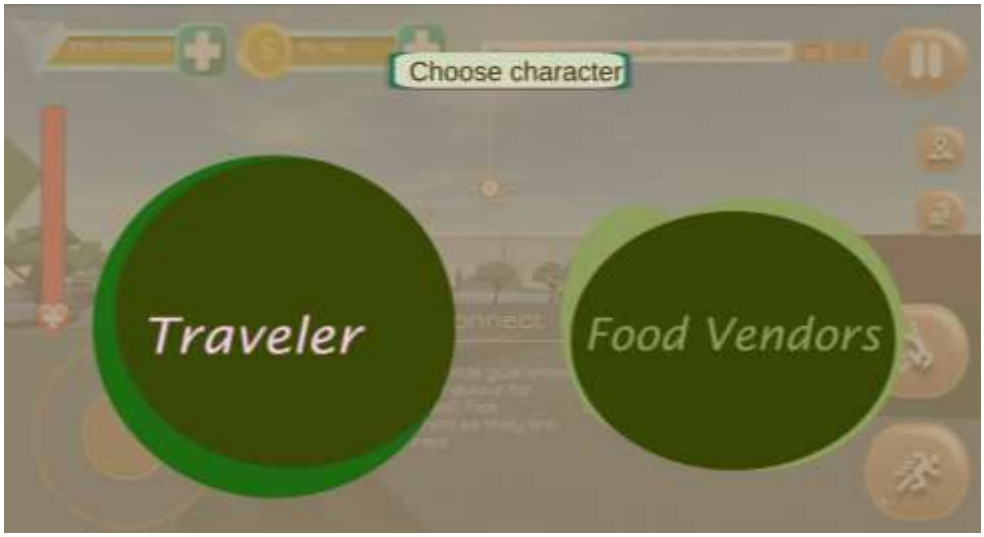


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Fig. 5. Choose a Stone City Tourism Game Character

Fig. 6. Traveler Character Choices

5.4 Testing and analysis of Game Effectiveness

Effectiveness Testing uses test data based on data that has been obtained from questionnaires. The test scenario form is seen in table 3.

Table 3. Effectiveness Testing Form

No	Scenario Testing	Questionnaire Questions	Succeed	Fail
1	Scenario in opening the system with offline mode login and online mode	-I can open the system well -I can login in offline mode -I can login in online mode		
2	Main Menu scenario to choose the desired tourist destination	-I managed to open the main menu page -I managed to choose a map of the tourist destinations I want		
3	Scenarios for exploration functions in tourist destination	-I can explore inside tourist attractions -I can interact with other players as well as NPCs -I can see the identity of other players who are being encountered -I can use the chat feature for communication between players		
4	Transaction function scenario	-I managed to input the value of the transaction to be made -I can cancel an unapproved transaction -I managed to make a transaction with proof of log data information in etherscan. -My balance changes after the transaction process.		

Effective testing in this study is obtained from the percentage of respondents' success in completing the task that has been tested. In this study there are 12 tasks that must be completed by respondents. If the respondent is successful in completing the task that has been given, it will get a score of 1, while if the respondent does not succeed or fails in carrying out the task that has been given, it will get a score of 0. Completion rate or percentage of successful completion of task respondents comes from equation 2.

$$\text{Completion Rate Value } (\%) = \frac{\text{number of successfully completed tasks}}{\text{total number of tasks}} * 100\% \quad (2)$$

Respondents to this study were the general public and some people who have fields of work in game development and software development.

5.5. Effectiveness Testing

Effective testing in this study is obtained from the percentage of respondents' success in completing the task that has been tested. In this study there are 12 tasks that must be completed by respondents. If the respondent is successful in completing the task that has been given, it will get a score of 1, while if the respondent does not succeed or fails in carrying out the task that has been given, it will

get a score of 0. Completion rate or percentage of successful completion of the respondent's task comes from equation 3.

$$\text{Completion Rate Value (\%)} = \frac{\text{number of successfully completed tasks}}{\text{total number of tasks}} * 100\% \quad (3)$$

Respondents to this study were the general public and some people who have fields of work in game development and software development. The respondents will test the system with the questions contained in the questionnaire and the results of the effectiveness test questionnaire can be seen in table 4.1

Table 4. Effectiveness Test Results

No	Name	Number of Tasks Successfully Performed	Total Tasks	Completion Rate value
1	Respondent 1	13	13	100%
2	Respondent 2	13	13	100%
3	Respondent 3	13	13	100%
4	Respondent 4	13	13	100%
5	Respondent 5	13	13	100%
6	Respondent 6	13	13	100%
7	Respondent 7	13	13	100%
8	Respondent 8	13	13	100%
9	Respondent 9	13	13	100%
10	Respondent 10	13	13	100%

Based on ISO / IEC 9126 states that the system can be said to be effective if the percentage of success of respondents when able to complete the task is 78% or more. In the table above, the percentage of respondents who can complete the task is 100%. Therefore, blockchain-based transaction sites in stone city tourism simulation games can be said to be EFFECTIVE with an efficiency rate of 100%.

6. Conclusion

User Response Testing using several variables that affect the cost and effectiveness of transaction speed. In this study, the conclusions obtained are as follows:

1. Trial transaction system using Ethereum also has better results that is faster transaction speed than Bitcoin. Ethereum has an average speed of 3.8 seconds per transaction with gas price 30 Gwei, while bitcoin has an average speed of 7 minutes per transaction with the same Gas Price.
2. Test the effectiveness of blockChain-based transaction system in stone city tourism simulation game can be said to be effective with an effectiveness rate of 100%.

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