МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ

ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

«ВОРОНЕЖСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»

(ФГ БОУ ВО «ВГТУ», ВГТУ)

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| Факультет информационных технологий и компьютерной безопасности |

(факультет)

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| Кафедра | Систем информационной безопасности |

Отчёт по лабораторной работе №15

|  |  |  |
| --- | --- | --- |
| по дисциплине | | Сети и системы передачи информации |
|  | |  |
| Тема: | EIGRP | |

**Расчетно-пояснительная записка**

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| Разработал студент: | А. Г. Зимницкий |

Подпись, дата Инициалы, фамилия

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| Руководитель | доц. С.С. Куликов |

Подпись, дата Инициалы, фамилия

Подпись, дата Инициалы, фамилия

Защищена\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Оценка\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Дата

2022

Замечания руководителя

# Название устройства

|  |  |  |  |
| --- | --- | --- | --- |
| Название устройства | Тип и номер интерфейса | MAC-адрес интерфейса | IP-адрес интерфейса |
| Router0 | Serial0/0/0 | - | 192.168.136.9/30 |
| Router0 | Serial0/1/0 | - | 192.168.136.1/30 |
| Router0 | Serial0/1/1 | - | 192.168.136.5/30 |
| Router0 | Loopback0 | - | 192.168.137.1/24 |
| Router1 | Serial0/1/0 | - | 192.168.136.2/30 |
| Router1 | Serial0/1/1 | - | 192.168.136.13/30 |
| Router1 | Loopback0 | - | 192.168.138.1/24 |
| Router2 | Serial0/1/0 | - | 192.168.136.6/30 |
| Router2 | Serial0/1/1 | - | 192.168.136.17/30 |
| Router2 | Loopback0 | - | 192.168.139.1/24 |
| Router3 | Serial0/1/0 | - | 192.168.136.10/30 |
| Router3 | Serial0/1/1 | - | 192.168.136.21/30 |
| Router3 | Loopback0 | - | 192.168.140.1/24 |
| Router4 | Serial0/0/0 | - | 192.168.136.22/30 |
| Router4 | Serial0/1/0 | - | 192.168.136.18/30 |
| Router4 | Serial0/1/1 | - | 192.168.136.14/30 |
| Router4 | Loopback0 | - | 192.168.141.1/24 |

Настройка динамической маршрутизации с помощью EIGRP

show ip route

Router0

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B – BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area Gateway of last resort is not set

192.168.136.0/30 is subnetted, 6 subnets

C 192.168.136.0 is directly connected, Serial0/1/0

C 192.168.136.4 is directly connected, Serial0/1/1

C 192.168.136.8 is directly connected, Serial0/0/0

D 192.168.136.12 [90/2681856] via 192.168.136.2, 00:11:30, Serial0/1/0

D 192.168.136.16 [90/2681856] via 192.168.136.6, 00:10:26, Serial0/1/1

D 192.168.136.20 [90/2681856] via 192.168.136.10, 00:09:38, Serial0/0/0

C 192.168.137.0/24 is directly connected, Loopback0

D EX 192.168.138.0/24 [170/3449856] via 192.168.136.2, 00:11:30, Serial0/1/0

D EX 192.168.139.0/24 [170/3449856] via 192.168.136.6, 00:10:21, Serial0/1/1

D EX 192.168.140.0/24 [170/3449856] via 192.168.136.10, 00:09:38, Serial0/0/0

D EX 192.168.141.0/24 [170/3961856] via 192.168.136.6, 00:08:50, Serial0/1/1

[170/3961856] via 192.168.136.10, 00:08:50, Serial0/0/0

[170/3961856] via 192.168.136.2, 00:08:50, Serial0/1/0

Router1

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area Gateway of last resort is not set

192.168.136.0/30 is subnetted, 6 subnets

C 192.168.136.0 is directly connected, Serial0/1/0

D 192.168.136.4 [90/2681856] via 192.168.136.1, 00:12:37, Serial0/1/0

D 192.168.136.8 [90/2681856] via 192.168.136.1, 00:12:37, Serial0/1/0

C 192.168.136.12 is directly connected, Serial0/1/1

D 192.168.136.16 [90/2681856] via 192.168.136.14, 00:09:57, Serial0/1/1

D 192.168.136.20 [90/2681856] via 192.168.136.14, 00:09:57, Serial0/1/1

D EX 192.168.137.0/24 [170/3449856] via 192.168.136.1, 00:12:37, Serial0/1/0

C 192.168.138.0/24 is directly connected, Loopback0

D EX 192.168.139.0/24 [170/3961856] via 192.168.136.1, 00:11:28, Serial0/1/0

[170/3961856] via 192.168.136.14, 00:09:57, Serial0/1/1

D EX 192.168.140.0/24 [170/3961856] via 192.168.136.1, 00:10:45, Serial0/1/0

[170/3961856] via 192.168.136.14, 00:09:57, Serial0/1/1

D EX 192.168.141.0/24 [170/3449856] via 192.168.136.14, 00:09:57, Serial0/1/1

Router2

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGPD - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area Gateway of last resort is not set

192.168.136.0/30 is subnetted, 6 subnets

D 192.168.136.0 [90/2681856] via 192.168.136.5, 00:12:16, Serial0/1/0

C 192.168.136.4 is directly connected, Serial0/1/0

D 192.168.136.8 [90/2681856] via 192.168.136.5, 00:12:16, Serial0/1/0

D 192.168.136.12 [90/2681856] via 192.168.136.18, 00:07:42, Serial0/1/1

C 192.168.136.16 is directly connected, Serial0/1/1

D 192.168.136.20 [90/2681856] via 192.168.136.18, 00:10:41, Serial0/1/1

D EX 192.168.137.0/24 [170/3449856] via 192.168.136.5, 00:12:16, Serial0/1/0

D EX 192.168.138.0/24 [170/3961856] via 192.168.136.5, 00:12:16, Serial0/1/0

[170/3961856] via 192.168.136.18, 00:10:41, Serial0/1/1

C 192.168.139.0/24 is directly connected, Loopback0

D EX 192.168.140.0/24 [170/3961856] via 192.168.136.5, 00:11:29, Serial0/1/0

[170/3961856] via 192.168.136.18, 00:10:41, Serial0/1/1

D EX 192.168.141.0/24 [170/3449856] via 192.168.136.18, 00:10:41, Serial0/1/1

Router3

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B – BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area Gateway of last resort is not set

192.168.136.0/30 is subnetted, 6 subnets

D 192.168.136.0 [90/2681856] via 192.168.136.9, 00:12:13, Serial0/1/0

D 192.168.136.4 [90/2681856] via 192.168.136.9, 00:12:13, Serial0/1/0

C 192.168.136.8 is directly connected, Serial0/1/0

D 192.168.136.12 [90/2681856] via 192.168.136.22, 00:08:25, Serial0/1/1

D 192.168.136.16 [90/2681856] via 192.168.136.22, 00:11:24, Serial0/1/1

C 192.168.136.20 is directly connected, Serial0/1/1

D EX 192.168.137.0/24 [170/3449856] via 192.168.136.9, 00:12:13, Serial0/1/0

D EX 192.168.138.0/24 [170/3961856] via 192.168.136.9, 00:12:13, Serial0/1/0

[170/3961856] via 192.168.136.22, 00:11:24, Serial0/1/1

D EX 192.168.139.0/24 [170/3961856] via 192.168.136.9, 00:12:13, Serial0/1/0

[170/3961856] via 192.168.136.22, 00:11:24, Serial0/1/1

C 192.168.140.0/24 is directly connected, Loopback0

D EX 192.168.141.0/24 [170/3449856] via 192.168.136.22, 00:11:24, Serial0/1/1

Router4

192.168.136.0/30 is subnetted, 6 subnets

D 192.168.136.0 [90/2681856] via 192.168.136.13, 00:11:53, Serial0/1/1

D 192.168.136.4 [90/2681856] via 192.168.136.17, 00:10:48, Serial0/1/0

D 192.168.136.8 [90/2681856] via 192.168.136.21, 00:10:01, Serial0/0/0

C 192.168.136.12 is directly connected, Serial0/1/1

C 192.168.136.16 is directly connected, Serial0/1/0

C 192.168.136.20 is directly connected, Serial0/0/0

D EX 192.168.137.0/24 [170/3961856] via 192.168.136.17, 00:12:12, Serial0/1/0

[170/3961856] via 192.168.136.21, 00:12:12, Serial0/0/0

[170/3961856] via 192.168.136.13, 00:12:12, Serial0/1/1

D EX 192.168.138.0/24 [170/3449856] via 192.168.136.13, 00:12:12, Serial0/1/1

D EX 192.168.139.0/24 [170/3449856] via 192.168.136.17, 00:12:12, Serial0/1/0

D EX 192.168.140.0/24 [170/3449856] via 192.168.136.21, 00:12:12, Serial0/0/0

C 192.168.141.0/24 is directly connected, Loopback0

Настройка метрик маршрутизации протокола EIGRP

|  |  |  |  |
| --- | --- | --- | --- |
| Название устройства | Тип и номер интерфейса | Пропускная способность | Задержка (микросекундах) |
| Router0 | Serial0/0/0 | 1544 Kbit | 20000 |
| Router0 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router0 | Serial0/1/1 | 1544 Kbit | 20000 |
| Router0 | Loopback0 | 8000000 Kbit | 5000 |
| Router1 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router1 | Serial0/1/1 | 1544 Kbit | 20000 |
| Router1 | Loopback0 | 8000000 Kbit | 5000 |
| Router2 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router2 | Serial0/1/1 | 1544 Kbit | 20000 |
| Router2 | Loopback0 | 8000000 Kbit | 5000 |
| Router3 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router3 | Serial0/1/1 | 1544 Kbit | 20000 |
| Router3 | Loopback0 | 8000000 Kbit | 5000 |
| Router4 | Serial0/0/0 | 1544 Kbit | 20000 |
| Router4 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router4 | Serial0/1/1 | 1544 Kbit | 20000 |
| Router4 | Loopback0 | 8000000 Kbit | 5000 |

Для маршрутизатора Router0 рассчитайте характеристики маршрутов до подсети, смоделированной loopback-интерфейсом Router4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Названия устройств, через которые проходит маршрут | Объявленное расстояние (Advertised Distance) | Возможное расстояние (Feasible Distance) | Выполнение критерия возможного состояния (Feasible Condition) | Статус маршрута | Статус соседнего устройства |
| R1 | R1R4=3449856 | R0R1+AD=3961856 | AD<FD | Лучший | Successor |
| R2 | R2R4=3449856 | R0R2+AD=3961856 | AD<FD | Лучший | Successor |
| R3 | R3R4=3449856 | R0R3+AD=3961856 | AD<FD | Лучший | Successor |

Изменение параметров bandwidth и delay для создания резервного и основного маршрутов.

Формула метрики при следующих параметрах

EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0

Зависимость параметров: BW↑ Metric↓ | Delay↑ Metric↓

Новое состояние интерфейсов после изменения параметров

|  |  |  |  |
| --- | --- | --- | --- |
| Название устройства | Тип и номер интерфейса | Пропускная способность | Задержка (микросекундах) |
| Router0 | Serial0/0/0 | 1544 Kbit | 20000 |
| Router0 | Serial0/1/0 | 1000 Kbit | 40000 |
| Router0 | Serial0/1/1 | 1544 Kbit | 25000 |
| Router0 | Loopback0 | 8000000 Kbit | 5000 |
| Router1 | Serial0/1/0 | 1000 Kbit | 40000 |
| Router1 | Serial0/1/1 | 1000 Kbit | 40000 |
| Router1 | Loopback0 | 8000000 Kbit | 5000 |
| Router2 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router2 | Serial0/1/1 | 1544 Kbit | 25000 |
| Router2 | Loopback0 | 8000000 Kbit | 5000 |
| Router3 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router3 | Serial0/1/1 | 1544 Kbit | 20000 |
| Router3 | Loopback0 | 8000000 Kbit | 5000 |
| Router4 | Serial0/0/0 | 1544 Kbit | 20000 |
| Router4 | Serial0/1/0 | 1544 Kbit | 20000 |
| Router4 | Serial0/1/1 | 1544 Kbit | 20000 |
| Router4 | Loopback0 | 8000000 Kbit | 5000 |

Расчёт метрик после изменения параметров

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Названия устройств, через которые проходит маршрут | Объявленное расстояние (Advertised Distance) | Возможное расстояние (Feasible Distance) | Выполнение критерия возможного состояния (Feasible Condition) | Статус маршрута | Статус соседнего устройства |
| R1 | R1R4=  4 864 000 | R0R1+AD=  5 888 000 | FALSE | Не выбран | Не выбран |
| R2 | R2R4=  3 577 856 | R0R2+AD=  4 217 856 | R2R4<R0R3R4 true | Резервный | Feasible successor |
| R3 | R3R4=  3 449 856 | R0R3+AD=  3 961 856 | Лучший | Лучший | Successor |

BW 1000 Kbit, DLY 40000 usec

Show IP Route

Router0

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area

\* - candidate default, U - per-user static route, o - ODR

P - periodic downloaded static route

Gateway of last resort is not set

192.168.136.0/30 is subnetted, 6 subnets

C 192.168.136.0 is directly connected, Serial0/1/0

C 192.168.136.4 is directly connected, Serial0/1/1

C 192.168.136.8 is directly connected, Serial0/0/0

D 192.168.136.12 [90/3193856] via 192.168.136.10, 00:09:59, Serial0/0/0

D 192.168.136.16 [90/2937856] via 192.168.136.6, 01:31:43, Serial0/1/1

D 192.168.136.20 [90/2681856] via 192.168.136.10, 00:09:59, Serial0/0/0

C 192.168.137.0/24 is directly connected, Loopback0

D EX 192.168.138.0/24 [170/4473856] via 192.168.136.10, 00:09:59, Serial0/0/0

D EX 192.168.139.0/24 [170/3577856] via 192.168.136.6, 01:32:13, Serial0/1/1

D EX 192.168.140.0/24 [170/3449856] via 192.168.136.10, 00:09:59, Serial0/0/0

D EX 192.168.141.0/24 [170/3961856] via 192.168.136.10, 00:09:59, Serial0/0/0

Router1

192.168.136.0/30 is subnetted, 6 subnets

C 192.168.136.0 is directly connected, Serial0/1/0

D 192.168.136.4 [90/4224000] via 192.168.136.1, 00:01:01, Serial0/1/0

D 192.168.136.8 [90/4096000] via 192.168.136.1, 00:01:01, Serial0/1/0

C 192.168.136.12 is directly connected, Serial0/1/1

D 192.168.136.16 [90/4096000] via 192.168.136.14, 00:25:37, Serial0/1/1

D 192.168.136.20 [90/4096000] via 192.168.136.14, 00:25:37, Serial0/1/1

D EX 192.168.137.0/24 [170/4864000] via 192.168.136.1, 00:01:01, Serial0/1/0

C 192.168.138.0/24 is directly connected, Loopback0

D EX 192.168.139.0/24 [170/5376000] via 192.168.136.14, 00:25:37, Serial0/1/1

D EX 192.168.140.0/24 [170/5376000] via 192.168.136.14, 00:25:37, Serial0/1/1

[170/5376000] via 192.168.136.1, 00:01:01, Serial0/1/0

D EX 192.168.141.0/24 [170/4864000] via 192.168.136.14, 00:25:37, Serial0/1/1

Router2

192.168.136.0/30 is subnetted, 6 subnets

D 192.168.136.0 [90/4096000] via 192.168.136.5, 00:02:16, Serial0/1/0

C 192.168.136.4 is directly connected, Serial0/1/0

D 192.168.136.8 [90/2681856] via 192.168.136.5, 00:12:03, Serial0/1/0

D 192.168.136.12 [90/2809856] via 192.168.136.18, 01:33:43, Serial0/1/1

C 192.168.136.16 is directly connected, Serial0/1/1

D 192.168.136.20 [90/2809856] via 192.168.136.18, 01:33:43, Serial0/1/1

D EX 192.168.137.0/24 [170/3449856] via 192.168.136.5, 01:47:19, Serial0/1/0

D EX 192.168.138.0/24 [170/4089856] via 192.168.136.18, 01:33:43, Serial0/1/1

C 192.168.139.0/24 is directly connected, Loopback0

D EX 192.168.140.0/24 [170/3961856] via 192.168.136.5, 00:12:02, Serial0/1/0

D EX 192.168.141.0/24 [170/3577856] via 192.168.136.18, 01:33:43, Serial0/1/1  
Router3

192.168.136.0/30 is subnetted, 6 subnets

D 192.168.136.0 [90/4096000] via 192.168.136.9, 00:02:42, Serial0/1/0

D 192.168.136.4 [90/2809856] via 192.168.136.9, 00:12:28, Serial0/1/0

C 192.168.136.8 is directly connected, Serial0/1/0

D 192.168.136.12 [90/2681856] via 192.168.136.22, 01:47:44, Serial0/1/1

D 192.168.136.16 [90/2681856] via 192.168.136.22, 01:47:45, Serial0/1/1

C 192.168.136.20 is directly connected, Serial0/1/1

D EX 192.168.137.0/24 [170/3449856] via 192.168.136.9, 00:12:29, Serial0/1/0

D EX 192.168.138.0/24 [170/3961856] via 192.168.136.22, 01:47:43, Serial0/1/1

D EX 192.168.139.0/24 [170/3961856] via 192.168.136.22, 01:47:44, Serial0/1/1

C 192.168.140.0/24 is directly connected, Loopback0

D EX 192.168.141.0/24 [170/3449856] via 192.168.136.22, 01:47:47, Serial0/1/1

Router4

192.168.136.0/30 is subnetted, 6 subnets

D 192.168.136.0 [90/4096000] via 192.168.136.13, 00:03:33, Serial0/1/1

D 192.168.136.4 [90/2681856] via 192.168.136.17, 01:48:41, Serial0/1/0

D 192.168.136.8 [90/2681856] via 192.168.136.21, 00:13:32, Serial0/0/0

C 192.168.136.12 is directly connected, Serial0/1/1

C 192.168.136.16 is directly connected, Serial0/1/0

C 192.168.136.20 is directly connected, Serial0/0/0

D EX 192.168.137.0/24 [170/3961856] via 192.168.136.17, 01:48:41, Serial0/1/0

[170/3961856] via 192.168.136.21, 00:13:26, Serial0/0/0

D EX 192.168.138.0/24 [170/3449856] via 192.168.136.13, 01:48:40, Serial0/1/1

D EX 192.168.139.0/24 [170/3449856] via 192.168.136.17, 01:48:41, Serial0/1/0

D EX 192.168.140.0/24 [170/3449856] via 192.168.136.21, 01:48:43, Serial0/0/0

C 192.168.141.0/24 is directly connected, Loopback0

Аутентификация сетевых устройств

Router0

Router(config-if)#do show ip eigrp neighbors

IP-EIGRP neighbors for process 1

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 192.168.136.6 Se0/1/1 14 01:45:09 40 1000 0 86

1 192.168.136.10 Se0/0/0 11 00:22:56 40 1000 0 84

Router1

Router(config-if)#do show ip eigrp neighbors

IP-EIGRP neighbors for process 1

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 192.168.136.14 Se0/1/1 13 00:39:43 40 1000 0 70

После конфигурации аутентификации сетевых устройств

Router0

Router#show ip eigrp neighbors

IP-EIGRP neighbors for process 1

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 192.168.136.10 Se0/0/0 14 00:10:45 40 1000 0 46

1 192.168.136.6 Se0/1/1 13 00:06:57 40 1000 0 64

2 192.168.136.2 Se0/1/0 13 00:00:25 40 1000 0 136

Router1

Router#show ip eigrp neighbors

IP-EIGRP neighbors for process 1

H Address Interface Hold Uptime SRTT RTO Q Seq

(sec) (ms) Cnt Num

0 192.168.136.14 Se0/1/1 13 00:07:23 40 1000 0 54

1 192.168.136.1 Se0/1/0 10 00:00:20 40 1000 0 82