EIGRP Metric:

EIGRP uses metric to select the best route from all available routes for destination. Metric has five components.1.Bandwidth, 2.Load, 3.Delay, 4.Reliability and 5.MTU. From these only bandwidth and delay are by default enabled. One feature of EIGRP is that it uses various factors to calculate the metric for its path. EIGRP metric values, by default, utilize bandwidth value and delay value but also consider interface load and reliability.

K Value	Component	Description
K1	Bandwidth	Lowest bandwidth of route
K2	Load	Worst load on route based on packet rate
K3	Delay	Cumulative interface delay of route
K4	Reliability	Worst reliability of route based on keep alive
K5	MTU	Smallest MTU in path [Not used in route calculation]

```
R1#show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  Redistributing: eigrp 1
  EIGRP-IPv4 Protocol for AS(1)
    Metric weight K1=1, K2=0. K3=1, K4=0, K5=0
```

Bandwidth (K1):

EIGPR picks lowest bandwidth from all outing-going interfaces of route to the destination network. Bandwidth is amount of data that can be transmitted in a fixed amount of time. The bandwidth in the calculation of the EIGRP metric uses the minimum value on the route.

```
R1#show interfaces g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is iGbE, address is 500b.0001.0000 (bia 500b.0001.0000)
  Internet address is 10.1.12.1/30
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
```

Load (K2):

Load is a dynamic value that changes frequently. It is based on packet rate and bandwidth of interface. It calculates the volume of traffic passing through the interface in comparison of maximum capacity. It is expressed on a scale of 255 where 1 represent that an interface is empty and 255 represent that an interface is fully utilized. Since data flows from both directions, router maintains two separate metric counters; Txload for outgoing traffic and Rxload for incoming traffic.

```
R1#show interfaces g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is iGbE, address is 500b.0001.0000 (bia 500b.0001.0000)
  Internet address is 10.1.12.1/30
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
```

Delay (K3):

Delay reflects the time taken by a packet in crossing the interface. It is measured in fractions of seconds.

```
R1#show interfaces g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is iGbE, address is 500b.0001.0000 (bia 500b.0001.0000)
  Internet address is 10.1.12.1/30
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
```

Reliability (K4):

Just like load, reliability is also a dynamic value. It compares all successfully received frames against all received frames. 100 % reliability indicates that all the frames, which we received, were good. We do not have any issue with physical link. If we have any issue with physical link, this value will be decrease.

MTU (K5):

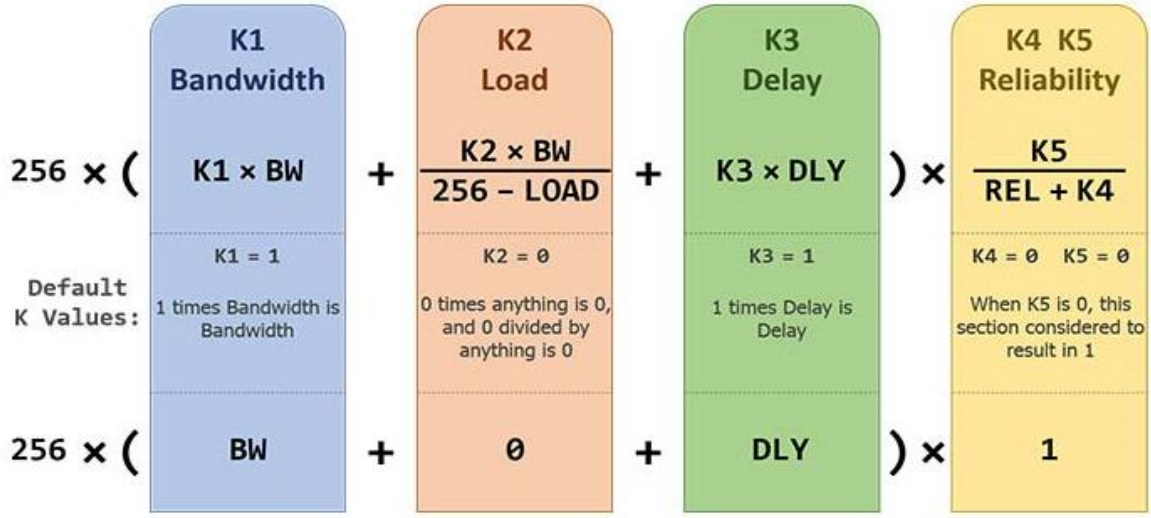
MTU stands for Maximum Transmission Unit. It is advertised with routing update, but it does not actively participate in metric calculation.

```
R1#show interfaces g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is iGbE, address is 500b.0001.0000 (bia 500b.0001.0000)
  Internet address is 10.1.12.1/30
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
```

Metric Calculation:

EIGRP Metric = 256*((10^7 / min. BW) + Delay)

=256*((10000000/Minimum BW) + Sum of Interface Delays/10)



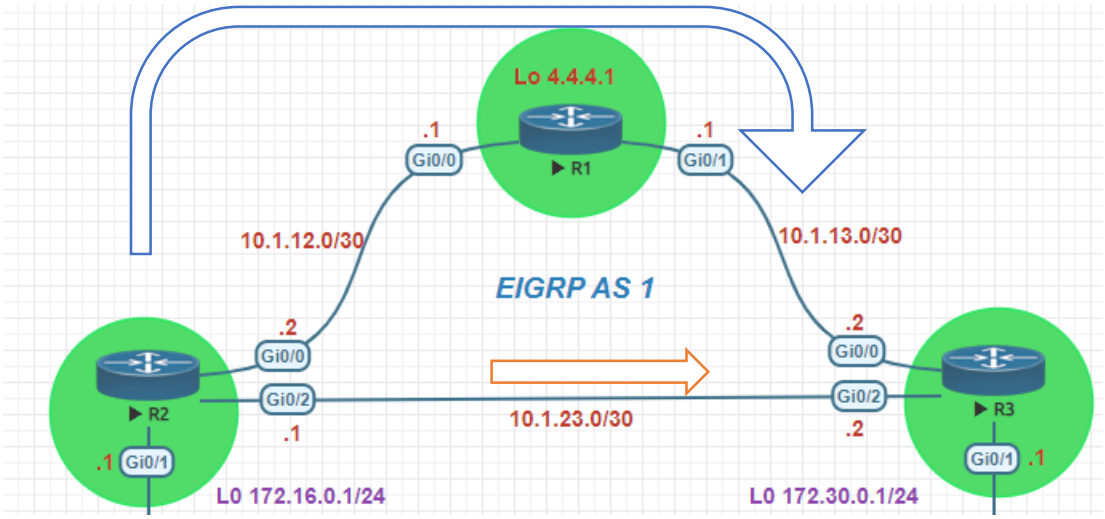
Where Bandwidth = 10000000/bandwidth (i), where bandwidth (i) is the least bandwidth of all outgoing interfaces on the route to the destination network represented in kilobits. Delay = delay (i) where delay (i) is the sum of the delays configured on the interfaces, on the route to the destination network, in tens of microseconds.
The term bandwidth represents the lowest bandwidth in kilobits per second. The delay value used is the total of all delay values in the route and is measured in “tens of microseconds”. Using these two inputs the easiest route can be found by EIGRP.

The values of load can be changed frequently based on bandwidth and rate of packet. Two metric counters are used here, Txload and Reload for outgoing and ingoing traffic. Maximum

Txload values are used for metric calculation if K2 is enabled.
Measures the maximum time taken to complete interface by packet. A sum of delay is used for calculation.

Here successful frames are compared with all frames and if reliability is 100% which means that received frames are good. Reliability is expressed in a fraction.

The maximum transmission unit is the expanded form of MTU. It is used to balance the cost of paths.




```
R2#show ip route eigrp
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D        10.1.13.0/30 [90/3072] via 10.1.23.2, 02:56:51, GigabitEthernet0/2
                      [90/3072] via 10.1.12.1, 02:56:51, GigabitEthernet0/0
```

```
R2#  show interfaces g0/0 | sec BW
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
```

```
R1#show interfaces g0/1 | sec BW
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
```

EIGRP Metric = 256*((10000000/Minimum BW) + Sum of Interface Delays/10)

EIGRP Metric = 256*(10000000/1000000) + 10+10/10)

EIGRP Metric = 256*(10) +20/10)

EIGRP Metric = 256*(10) +2)

EIGRP Metric = 256*12

EIGRP Metric = **3072**