1a) Time spent to get to first router: $t = \frac{8Mb}{2Mb/s} = \boxed{4s}$
Time spent in total: $4s * 3\ links = \boxed{12s}$

1b) $\frac{1*10^4 bits}{2*10^6 bits/s} = \frac{1}{2*10^2}s = \boxed{0.005s}$
The second packet will be fully received at the first switch at time $t = \boxed{0.01s}$

1c)

$$t = \frac{(n+p+1)L}{R}$$
$$t = \frac{(3+800+1)*10^4 bits}{2*10^6 bits/s}$$
$$t = \frac{8.04*10^6 bits}{2*10^6 bits/s}$$
$$t = \boxed{4.02s}$$

By utilizing message segmentation, the time taken to transmit the message is lowered by a factor of 3. This is because we are fully utilizing all links in the network as much as possible, instead of using one link at a time.

2a) $R = 2 * 10^6 bits/s$
$d_{prop} = \frac{2*10^7 m}{2.5*10^8 m/s} = \frac{2}{25}s = \boxed{0.08s}$

$R * d_{prop} = 0.08 * 2 * 10^6 = 0.16 * 10^6 = \boxed{1.6 * 10^5}$

2b) When the first packet is sent through the link, it spends 0.08 seconds in the link. During this 0.08 seconds, the link continues to accept bits at a rate equal to the bandwidth (2Mbps). So the total number of bits in the link is $0.08s * 2 * 10^6 b/s = \boxed{1.6 * 10^5 bits}$.

2c) The bandwidth-delay product is the maximum number of bits that can be in the link at any given time.

2d)$w_{bit} = \frac{m}{R*d_{prop}} = \frac{2*10^7 m}{1.6*10^5 m/b} = \frac{200}{1.6} = \boxed{125m}$
If a bit is 125m wide, then a bit is a little more than twice as wide as a football field.

2e) $w_{bit} = \frac{m}{R*d_{prop}} = \boxed{\frac{m}{R * \frac{m}{s}}}$

3)

$$F = 1.5 * 10^{10} bits$$
$$u_s = 3.0 * 10^7 bits/s$$
$$d_i = 2.0 * 10^6 bits/s$$

For client-server scenario: $D_{cs} = max\left(\frac{N*F}{u_s}, \frac{F}{d_i}\right)$

N, the number of users, is represented on the left hand side, has values of 10, 100, and 1000. u, the upload speed, has values of $3 * 10^5$, $7 * 10^5$, and $2 * 10^6$ and is represented on the bottom. All units in the table are seconds.

10	7500	7500	7500
100	50000	50000	50000
1000	$5 * 10^5$	$5 * 10^5$	$5 * 10^5$
	$3 * 10^5$	$7 * 10^5$	$2 * 10^6$

For peer-to-peer scenario: $D_{p2p} = max\left(\frac{F}{u_s}, \frac{F}{d_i}, \frac{N*F}{\sum u_i}\right)$

Again, N is represented on the left and u at the bottom.