

# Latency Numbers Every Programmer Should Know

## (Peter Norvig and Jeff Dean)

L1 cache reference	0.5ns		
Branch mispredict	5ns		
L2 cache reference	7ns		
Mutex lock/unlock	25ns		
Main memory reference	100ns		
Compress 1K with Zippy	3,000ns	3us	
Send 1K over 1Gbps network	10,000ns	10us	
Read 4K randomly from SSD	150,000ns	150us	
Read 1MB sequentially from RAM	250,000ns	250us	
Round trip within a datacenter	500,000ns	500us	
Read 1MB sequentially from SSD	1,000,000ns	1,000us	1ms
Hard disk seek	10,000,000ns	10,000us	10ms
Read 1MB sequentially from disk	20,000,000ns	20,000us	20ms
Send packet CA->Netherlands->CA	150,000,000ns	150,000us	150ms