ONE
Optimizing Network Environment

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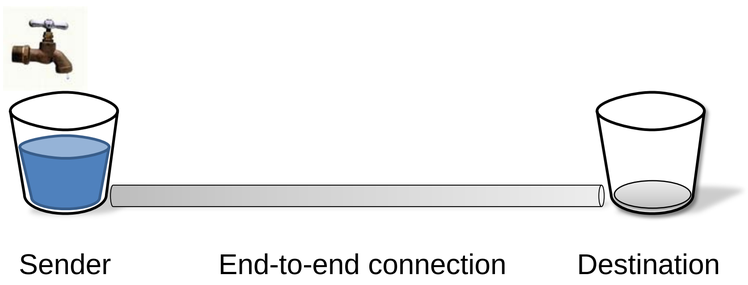
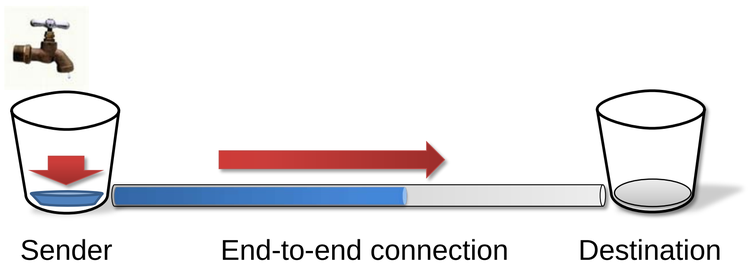
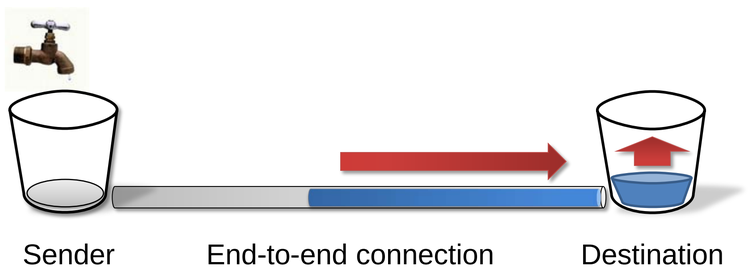
The Bandwidth-Delay Product "Conundrum"

- Heavy data transfer applications relying on TCP protocol suffer from TCP's window-based behavior
- TCP window used primarily for congestion control

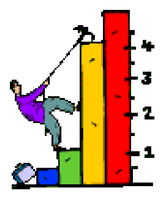






- Sender transmits a "window" (or bucket) of bytes, then waits until the destination signals reception
- If the window is not large enough, the "pipe" (or link) is not filled completely → underutilization
- The higher the latency or RTT, the more the sender has to wait for an ACK
- Longer, higher capacity links tend to be more affected

- TCP window grows slowly (usually one segment size a time)
- When loss or congestion occurs, the window size is abruptly reduced (AIMD - Additive Increase, Multiplicative Decrease behavior)
- The *sawtooth* pattern
- In high capacity links, throughput might take a long time to recover after TCP congestion control reduces the window



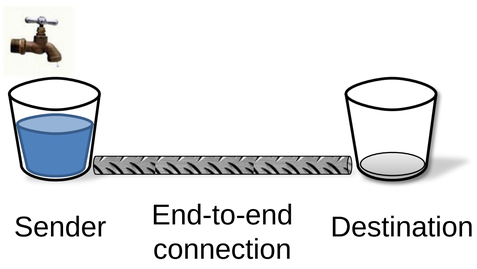
Solution

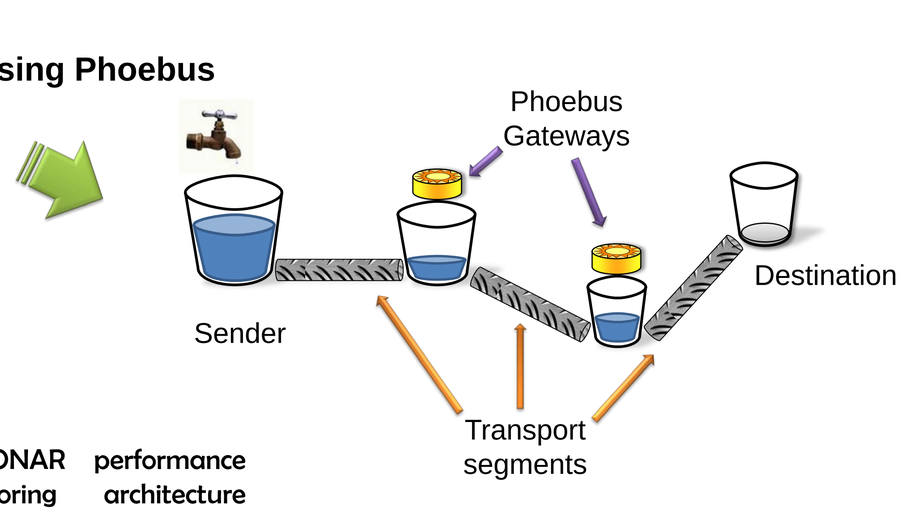
- Modify TCP? Many systems to reconfigure/patch
- New end-to-end transport protocol? Again, many systems to reconfigure/patch

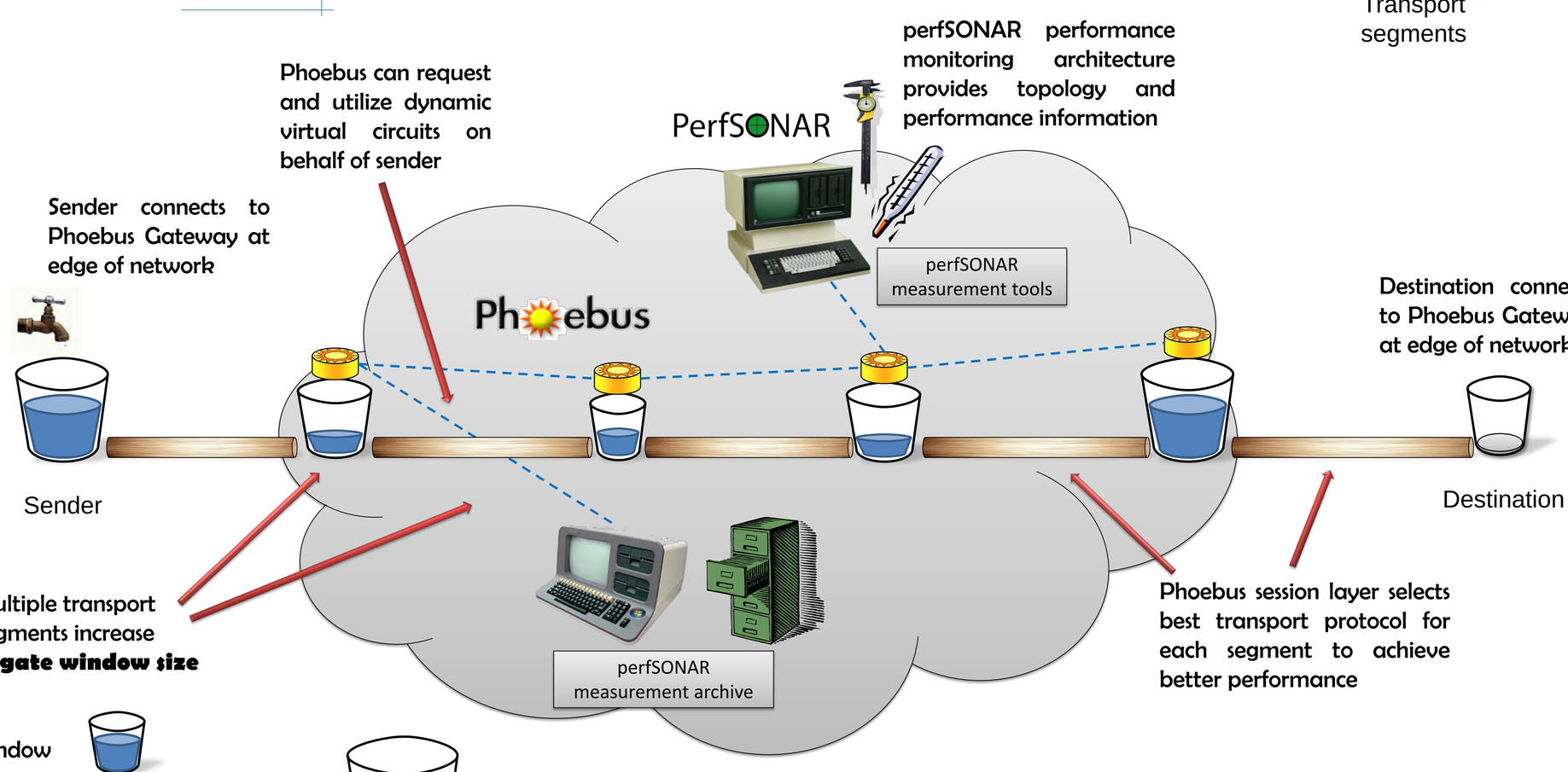
- Our answer: **ONE = Phoebus + perfSONAR**

What is **Phoebus**:

- A session layer on top of TCP/IP transport layer, implemented by Phoebus Gateways (PGs)
- This session layer is capable of dividing a single end-to-end TCP connection into multiple network (transport) segments
- Phoebus manages each segment , chooses best transport protocol for it → increased performance
- Phoebus can utilize dynamic virtual circuits for segments
- Loss and retransmission are limited to segments, not to whole end-to-end connection → faster throughput recovering times, optimized congestion control
- Can use available performance measurement architecture – such as **perfSONAR** – to gather topology and performance data







Poster: Marcos Portnoi