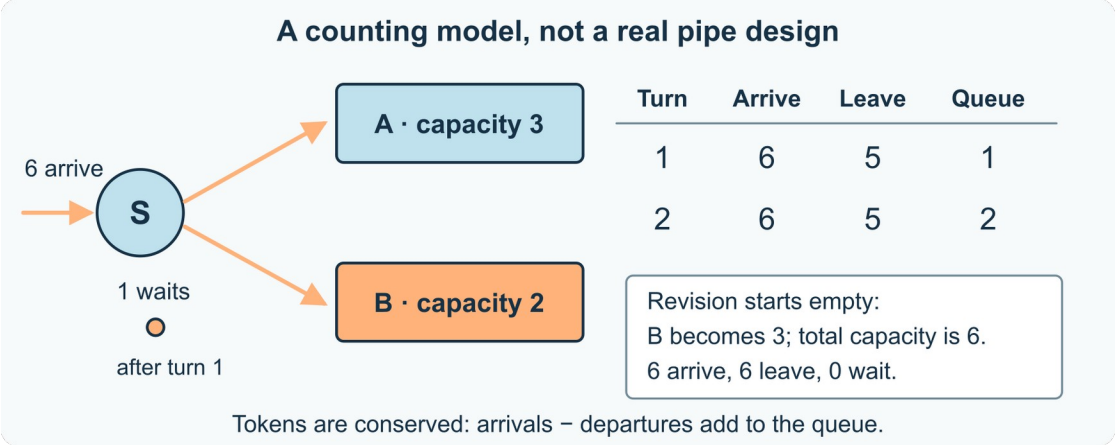
A flow network on paper

What does a branching network allow, and where could a bottleneck appear?

Use drawn tokens to explore a branching network with a limited capacity.

Investigate | 10–20 minutes, or one small comparison | Scrap paper and a pencil or pen, The supplied original model; no account, purchase or online search needed

Start here Draw a source S feeding two branches A and B. Write: six tokens arrive each turn.



Six arrive; five can leave

1 State the rules

Branch A can pass at most three tokens per turn; B can pass at most two. Tokens do not disappear or jump a branch.

2 Trace one turn

Send six tokens to S. Move three along A and two along B. Mark the remaining token as waiting at S.

3 Trace another turn

Add six new tokens. There are now seven waiting or arriving; five can leave. Two remain. Record arrivals, departures and the queue.

4 Change one limit

Raise B's capacity to three in a fresh model. From an empty start, all six incoming tokens can leave each turn. Explain the difference.

Original model two display channels

The tokens and turns are invented counting units, not measurements from a water system.

• Original limits: 3 + 2 = 5 departures for 6 arrivals; one token is left after turn 1.

• Turn 2 starts with 1 waiting plus 6 new tokens. Five leave and 2 remain.

• With B changed to 3, total capacity is 6. An empty-start turn has 6 arrivals, 6 departures and no queue.

What this example can show Real water networks involve pressure, losses and other constraints. A token model cannot establish safe pipe sizes or real flow rates.

A different way

Use six small pencil marks, move imagined tokens aloud, or ask a partner to record your counts. No counters are required.

If you want to go further

Choose an incoming rate of four tokens per turn. Describe more than one valid split that stays within both branch limits.

Something to notice

Did I keep every token accounted for?

Read or explore more

Horizon topic Water Networks

https://launchhorizonhq.com/learn/water-networks/

Horizon topic Feedback Control

https://launchhorizonhq.com/learn/feedback-control/

Horizon topic Engineering

https://launchhorizonhq.com/learn/engineering/

OpenStax, Rice University Flow Rate and Its Relation to Velocity

https://openstax.org/books/college-physics-ap-courses/pages/12-1-flow-rate-and-its-relation-to-velocity

TeachEngineering, University of Colorado Boulder Engineering Design Process

https://www.teachengineering.org/popular-topics/engineering-design-process