# Intro To The Byzantine Generals Problem

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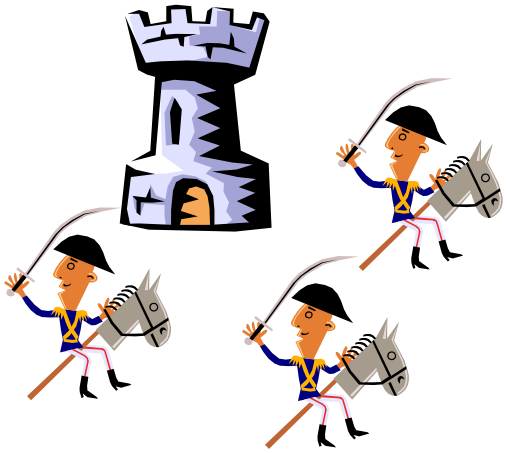
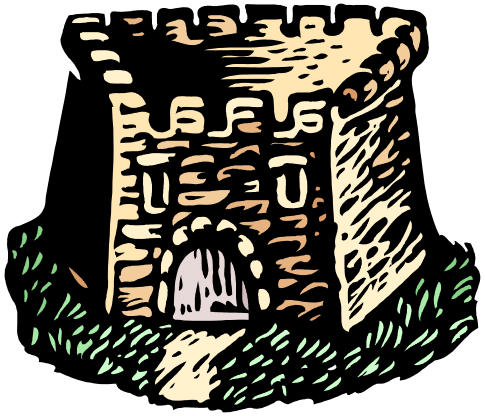
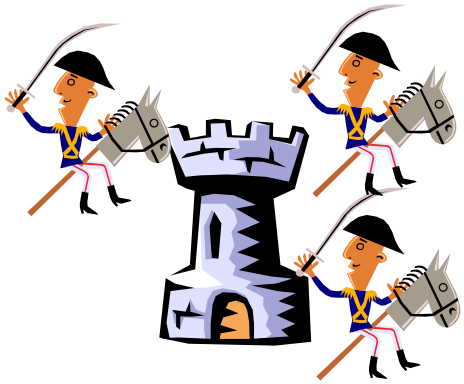
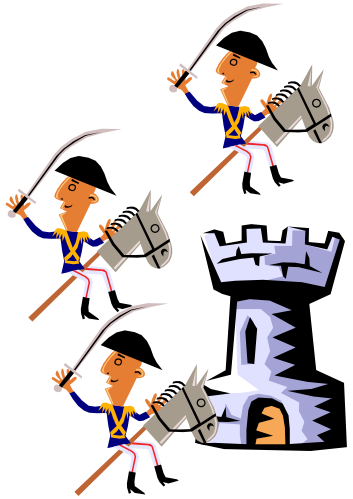
# Byzantine Generals Problem









# BGP – the Generals

- Loyal Generals
  - Behave according to the algorithm
    - **They decide upon the same plan**
      - Every loyal general must obtain the same v(1)…v(n)
    - **A small number of traitors shouldn't be able to force a bad decision**
      - If the $i^{th}$ general is loyal $\Rightarrow$ v(i) must be used by all (loyal) generals
- Traitorous Generals
  - Try to influence the final decision
  - Send any info they want

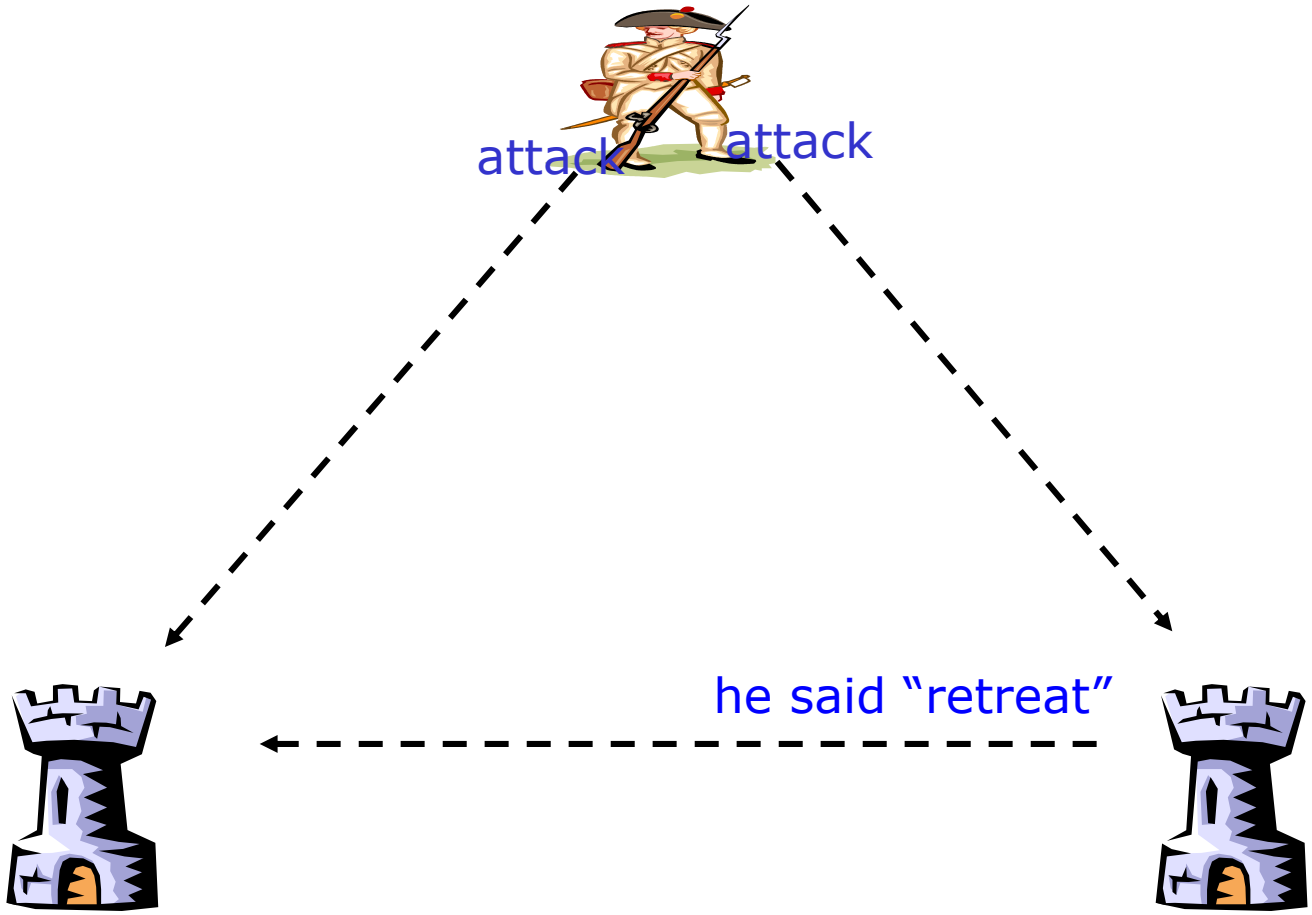
# Byzantine Generals Problem (formalism)

- 0 .. N-1 processes in a complete graph
- Process 0 needs to send a value v to all others such that
  - (IC1) If process 0 is non faulty then any non faulty process i receives v
  - (IC2) If processes i and j are non faulty, they receive the same value
- Note: 0 is non faulty, then IC1=>IC2

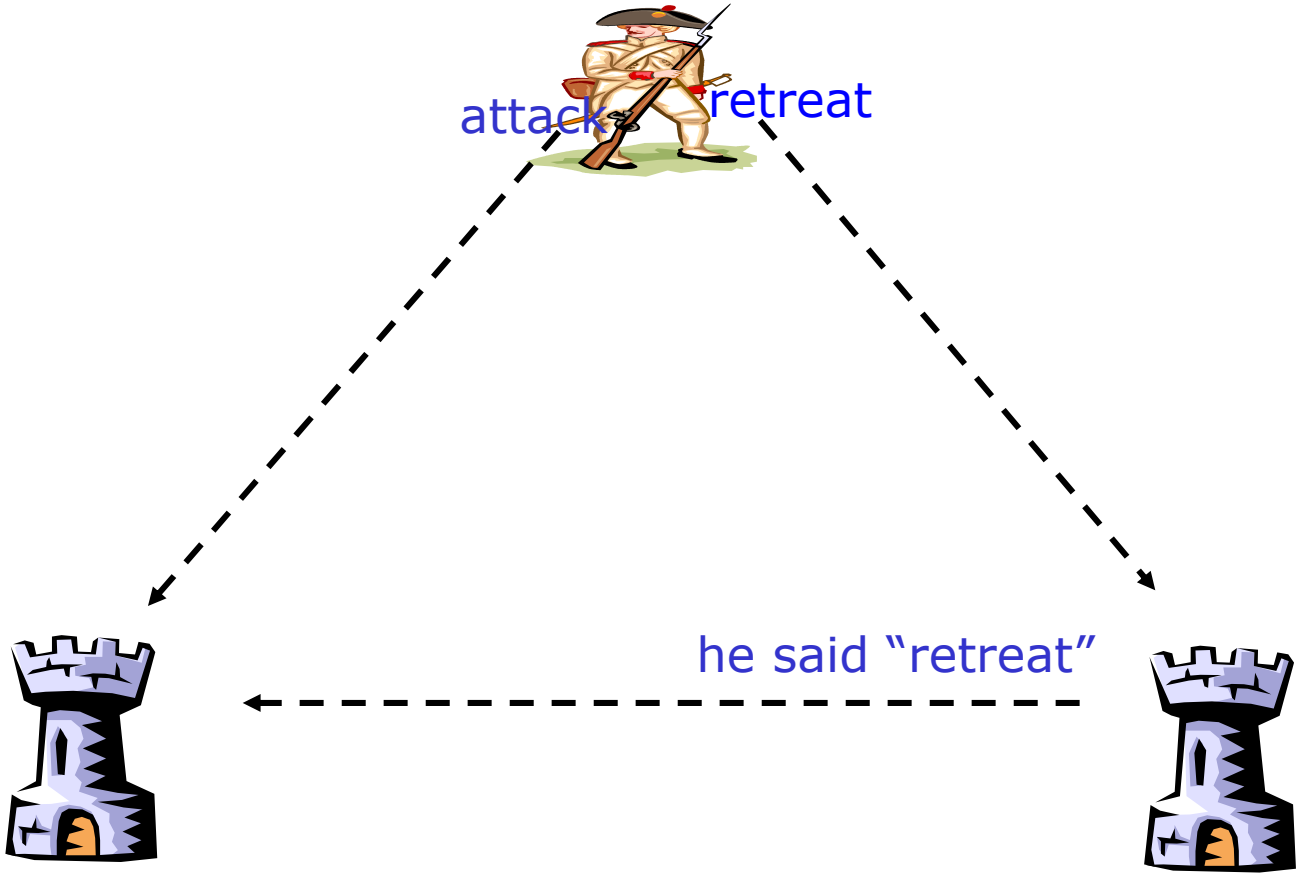
# Impossibility Results – Oral Msg

- Oral message – the content is entirely under the control of the sender
- No solution if more than 1/3 of the generals are traitorous

# Traitorous Lieutenant



# Traitorous General



# Impossibility Results – Generalization

- No solution with fewer than **3m+1** generals for **m** traitors
- Proof by contradiction: reduce the problem to the 3 generals problem
  - Assume **3m** (let's call them Albanians) or fewer generals can cope with m traitors
  - Build the solution with Byzantine generals