

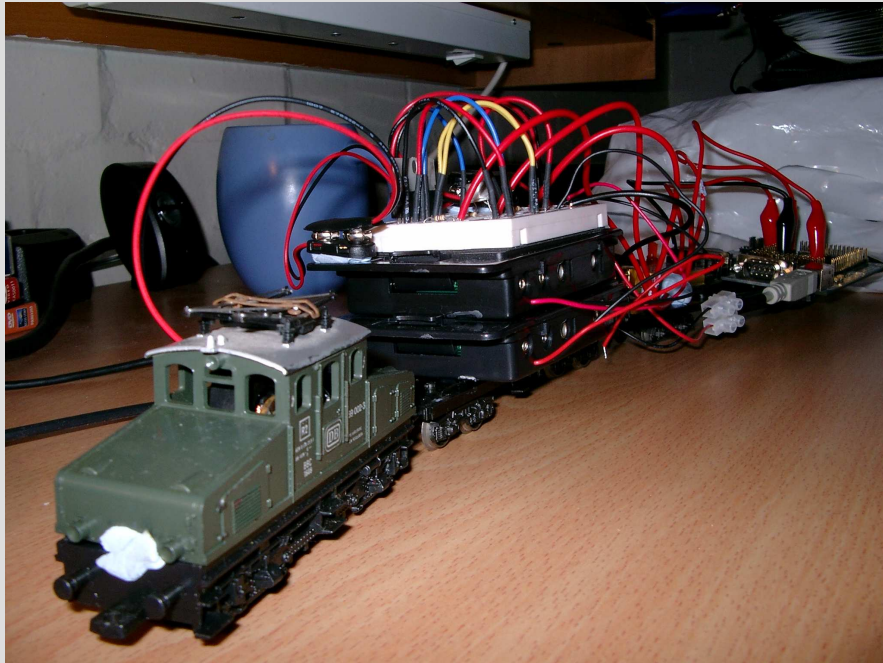
# **Guaranteeing Network Message Delivery with Memory Limited Real Time Systems**

Tony Chung

# Tonight

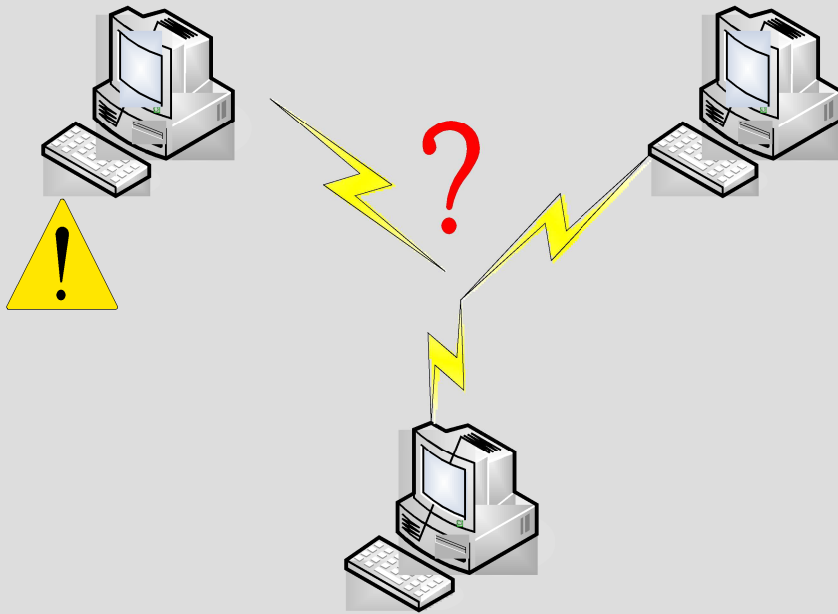
- Why? (Project)
- What Is A Network?
- How Do We Guarantee Delivery?
- Limitations
- One Approach...
- Conclusions

# Distributed Train Control System



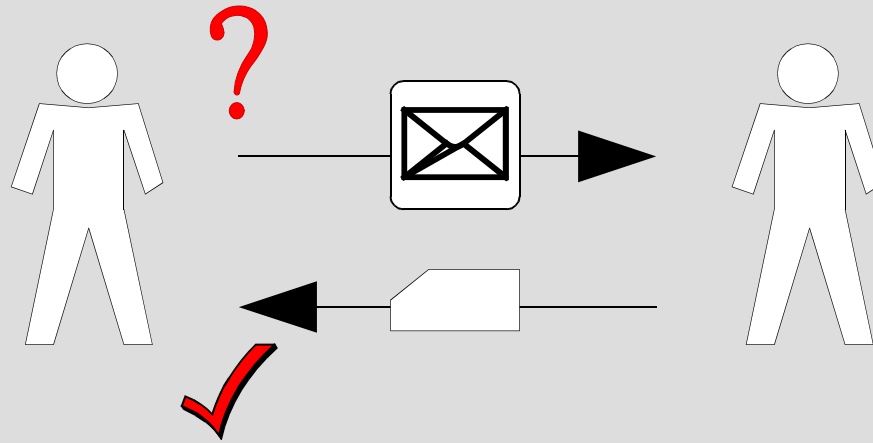
- Decentralized
- Fault tolerant
- Automatic
- Intelligent
- Wireless
- Aiming for AI – no PC!
- Needs a reliable network...

# What Is A Network?



- A network is a set of connected computers.
- Messages can be shared between those computers.
- Networks can be unreliable.
- Some applications require certainty of delivery.

# How Do We Guarantee Delivery?



- Messages must be confirmed.
- If a message is confirmed, it arrived.
- Keep trying until it gets there.

# Memory Limited Real Time Restrictions

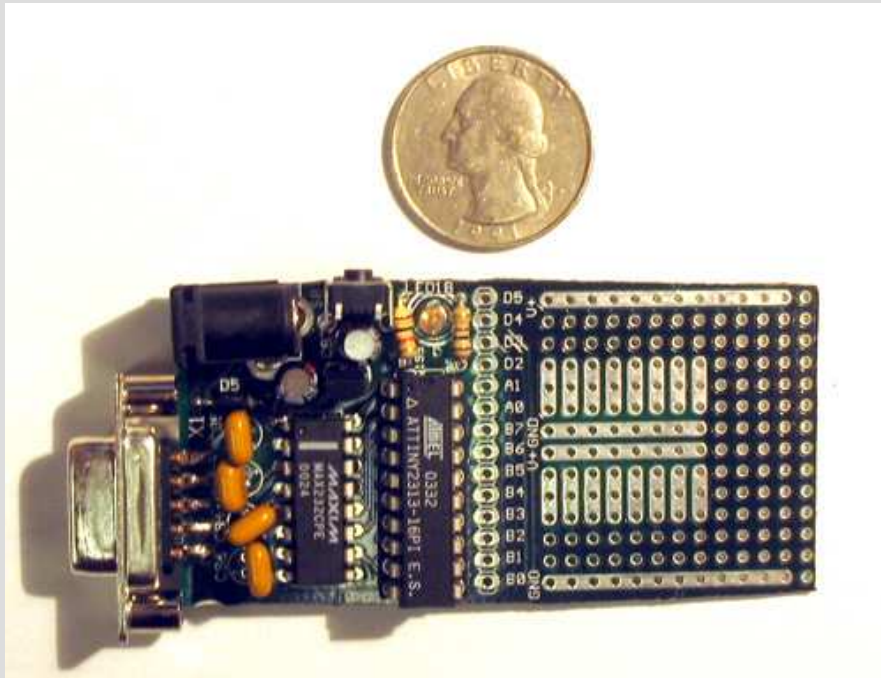
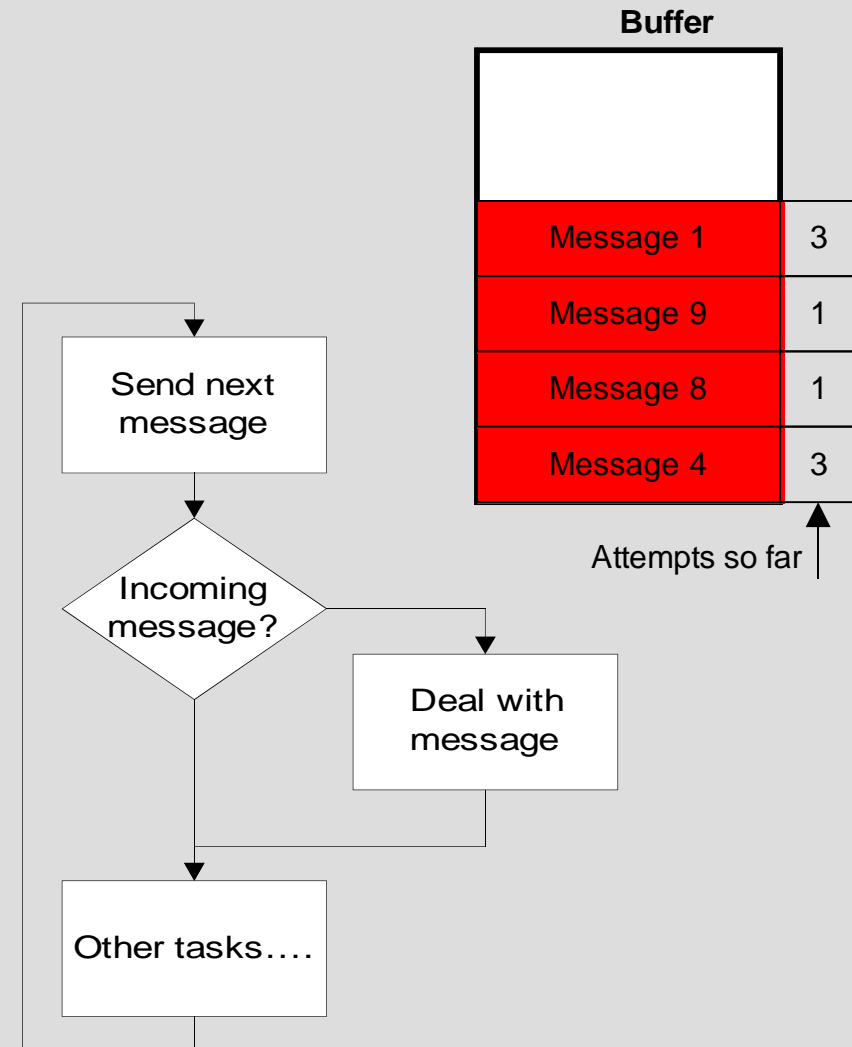


Image from: [www.ladyada.net/techproj/Atmex/index.html](http://www.ladyada.net/techproj/Atmex/index.html)

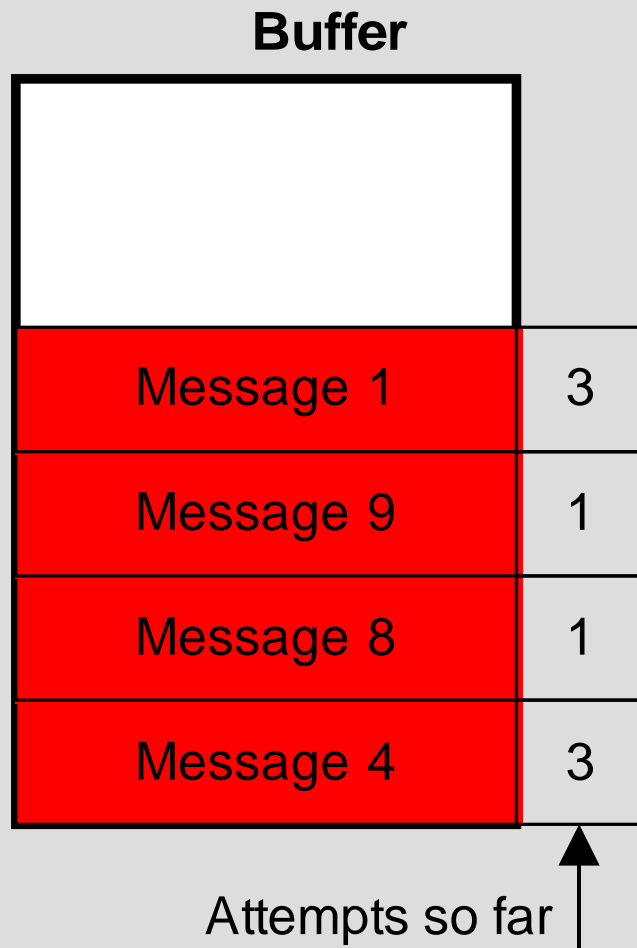
- Might have 1KB RAM
  - Desktop: 500MB
    - 500,000 times more!
  - How many SMS messages? 6 or 7?
  - Other data?
- Real time systems
  - No operating system
    - One thing at a time
  - Must keep working
    - Cant wait!

# One Approach...

- Buffer + Task Manager
  - Store outgoing messages
  - Run code in a loop
    - sending messages
    - receiving messages (and erasing confirmed)
    - running other tasks
- But:
  - What if a device is missing?
  - We are short on memory...



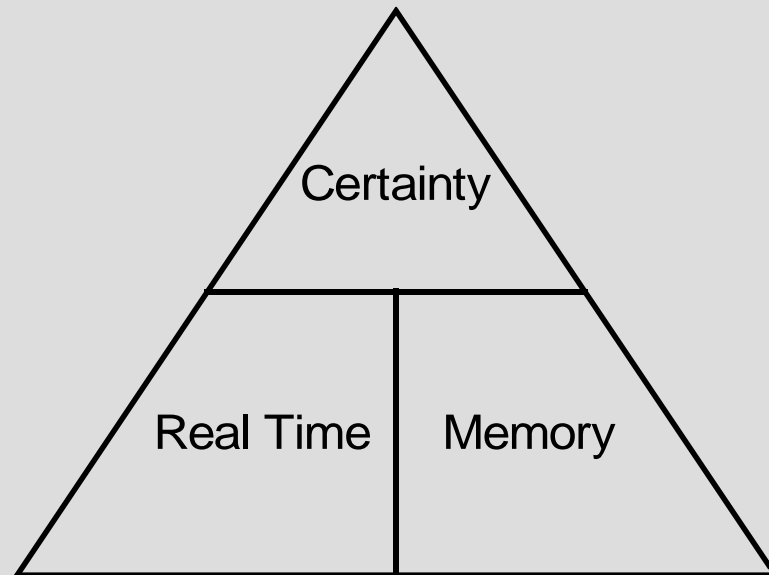
# Memory Limitation



- Buffer is larger with more messages.
- Solution:
  - Give messages urgency.
  - Non-urgent messages removed after 3 tries.
- Weak: buffer could still overflow.
- Good: No waiting, real time needs met.

# Conclusions

- Guaranteeing delivery is difficult:



- Sacrifice one...
- Assign priority to messages
- It is not possible to **both** allow the CPU to keep working and guarantee that **all** messages arrive.
- Other approaches may be required like:
  - refusing to buffer messages
  - waiting for responses for urgent messages (bypass buffer)
  - Allow threads

# Questions?

