

# Real Time and Quality of Service:

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\*disclaimer: These opinions do not necessarily reflect the RT/Embedded Forum participants, my employer, the US Government, your mother-in-law, etc.

\*\*claimer: But they -do- reflect my views on the problem....

# We represent two sides of the same coin...

- Predict the use of resources
- Ensure the appropriate use of resources
  - Consistent with the prediction
- Manage the use of resources

# Predicting Resources

- “Hard RT vs Soft RT” - Time as the resource:
  - Hard RT: Value of computation if it misses the time deadline is zero
  - Soft RT: Value of computation declines if it misses the time deadline
- But time is not the only resource of interest
  - Bandwidth, memory, disk, human attention...

# Ensuring Access to Resources

- Scheduling
  - Always based on some optimization function
  - Different optimization functions (user goals) produce radically different scheduling algorithms
- Monitoring
  - Actions to take when resource used incorrectly

# Managing Access to Resources

- It's a “system of systems” issue
  - Each component system has its own model of resource usage and consumption
  - Each component acts on this model in isolation
  - Components can interfere or even conflict
  - Component behaviors change
    - Internally, or externally due to new user needs

# Managing is the Hard Problem

- Need ways to express QoS properties
  - Independent of the systems that control resources
  - Independent of the systems that consume resources
  - Dynamically controlled by the end user
- A view from my industry (military C2):
  - Managing QoS will be to the 21st century what managing fuel and ammunition was in the 20th century...

# Telemedicine as an example domain

- Remote surgery, with TV and “waldos”
  - TV needs no jitter on single way feed
  - Robot needs round trip control loop
  - Temporal logic for drugs, anesthesia, etc
  - Others....
- We need to meet all of these different QoS requirements

# Where do we need to go?

- Characterization of the kinds of QoS properties for (complex, distributed) systems (QoS Forum)
  - Examples based on real-world problems
  - Leading to a taxonomy of concerns and expressions
- Mechanisms for distributing QoS properties through the system (RT Forum)
  - Example: Consistent notion of ‘priority’ to application, middleware, OS, network, etc...
- Measures for conformance to QoS properties (Both)
- Design patterns, rules, monitoring tools, etc.... (Both)