Embedded Systems

4a. Example Network Processor

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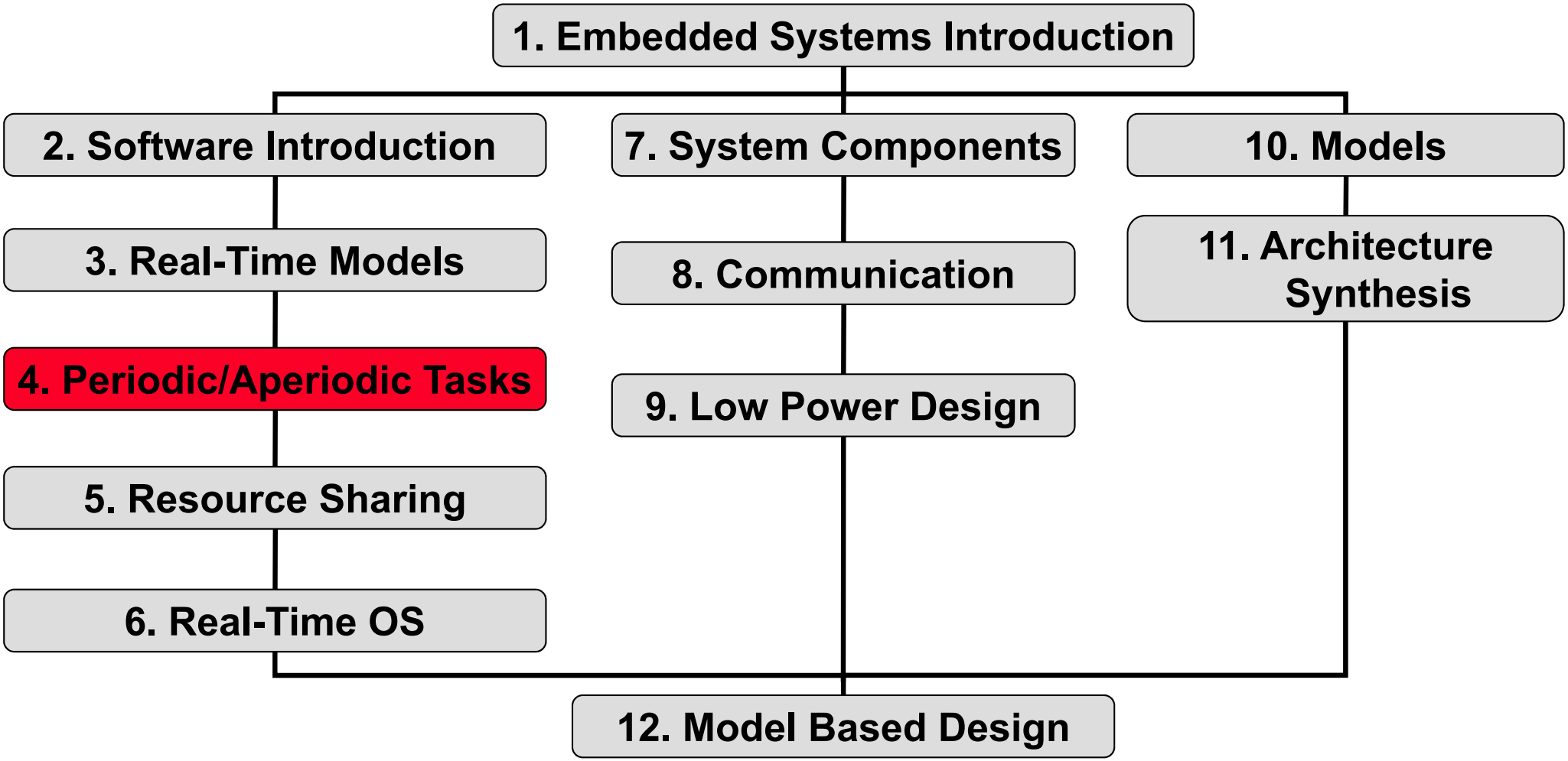
Contents of Course

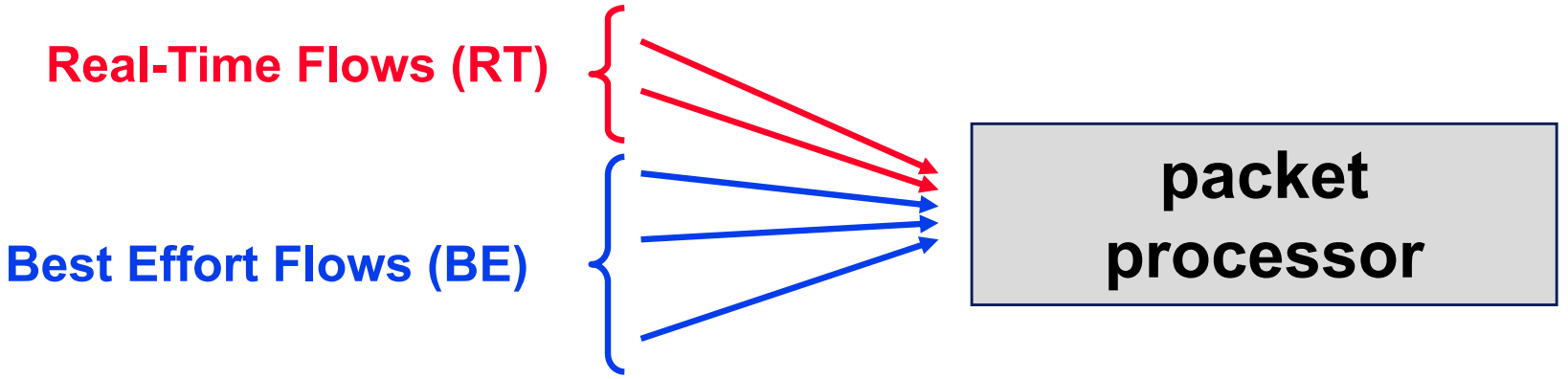


Software-Based NP

Network Processor:
Programmable Processor Optimized to Perform Packet Processing

- How to Schedule the CPU cycles meaningfully?
  - Differentiating the level of service given to different flows
  - Each flow being processed by a different processing function

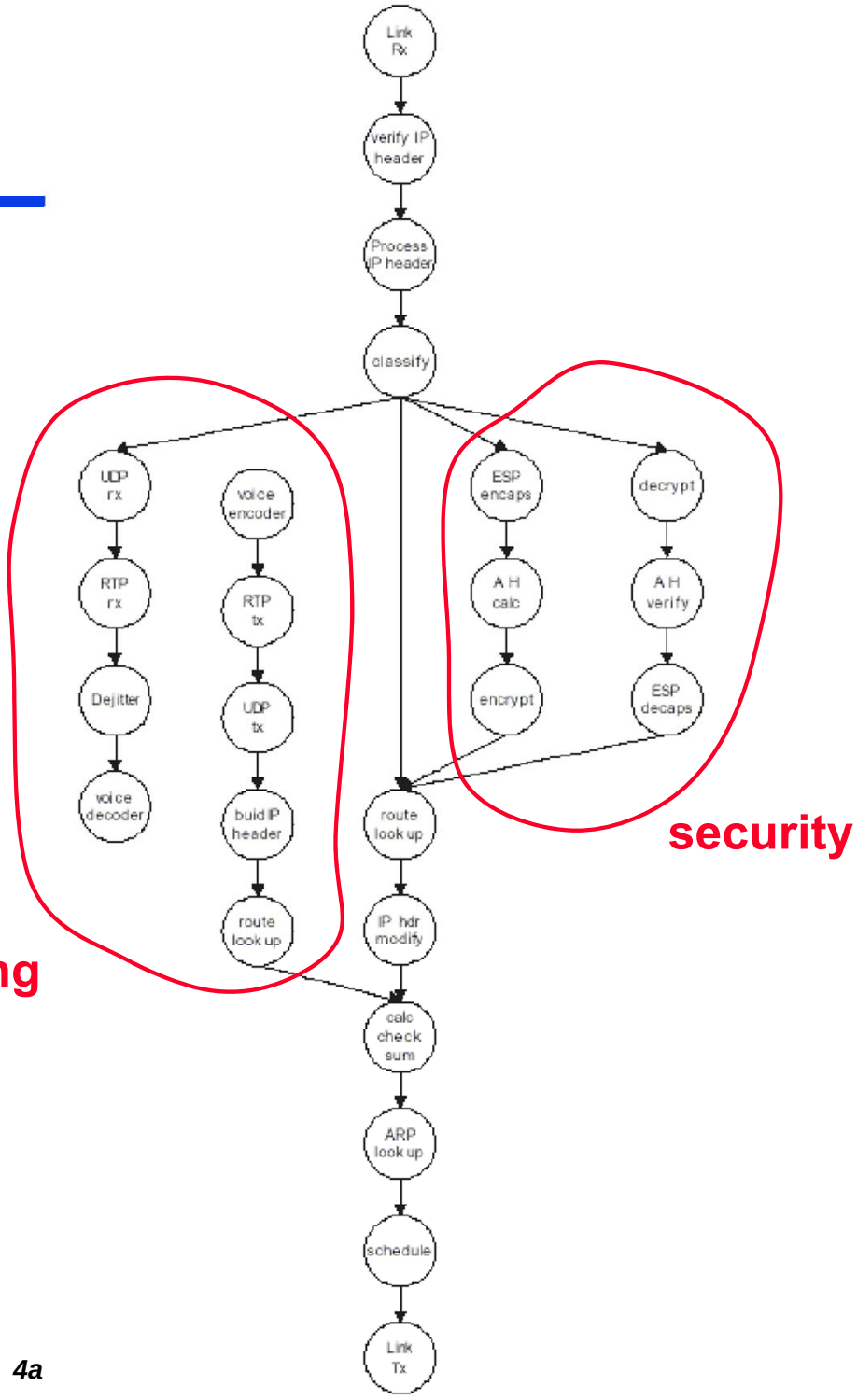
Our Model – Simple NP



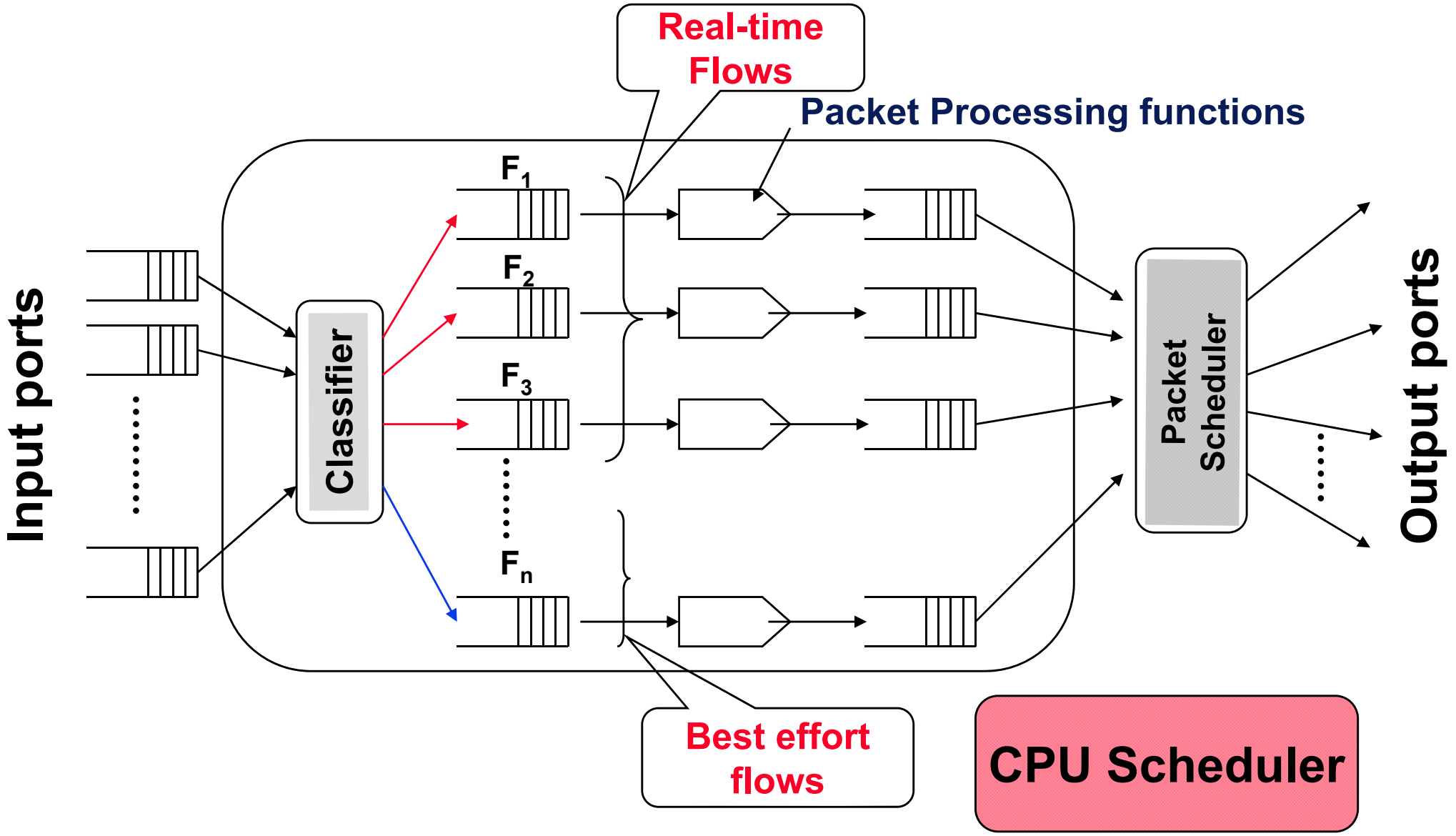
- Real-time flows have deadlines which must be met
- Best effort flows may have several QoS classes and should be served to achieve maximum throughput

Task Model

- Packet processing functions may be represented by directed acyclic graphs
- End-to-end deadlines for RT packets



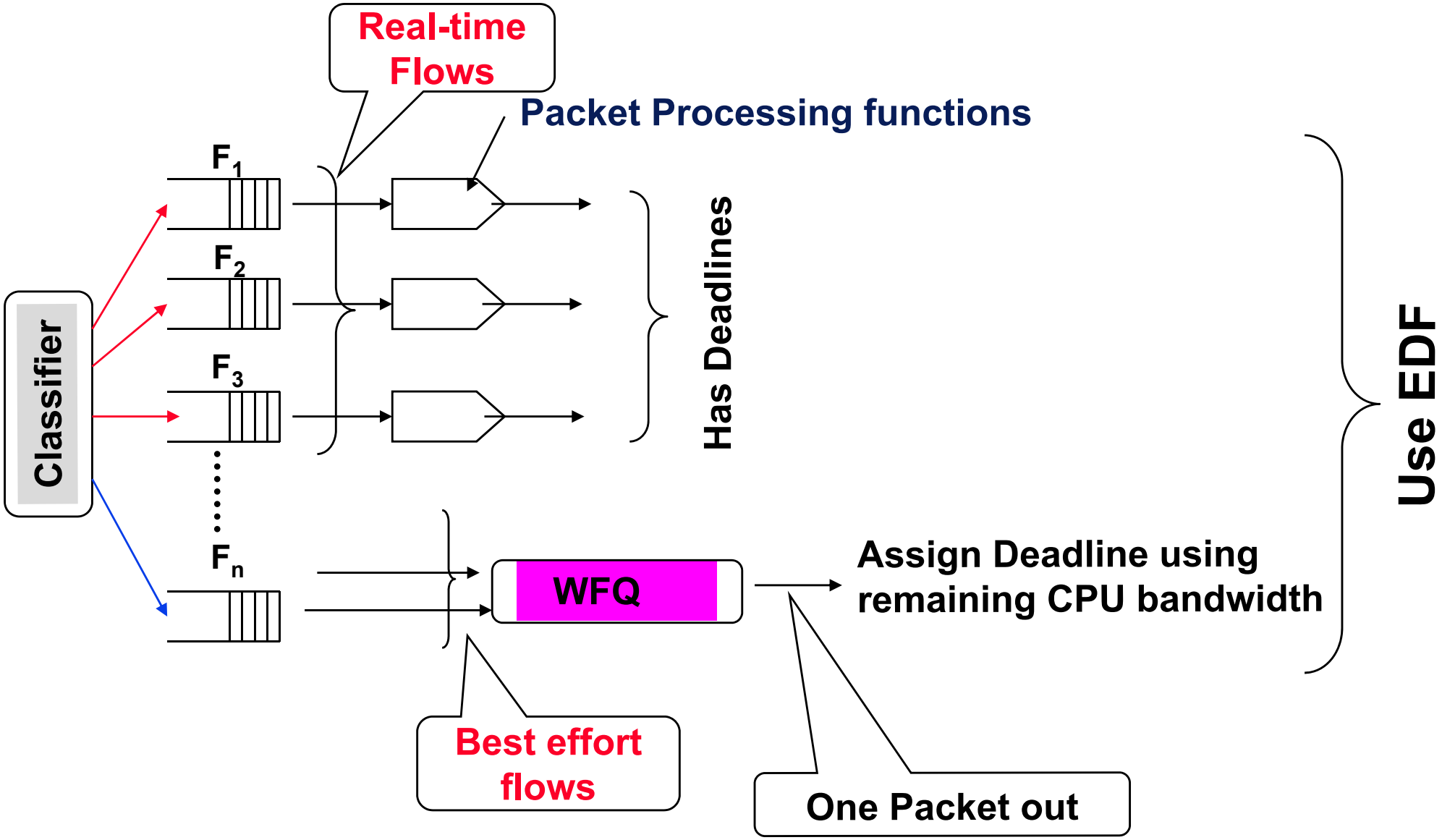
Architecture



CPU Scheduling

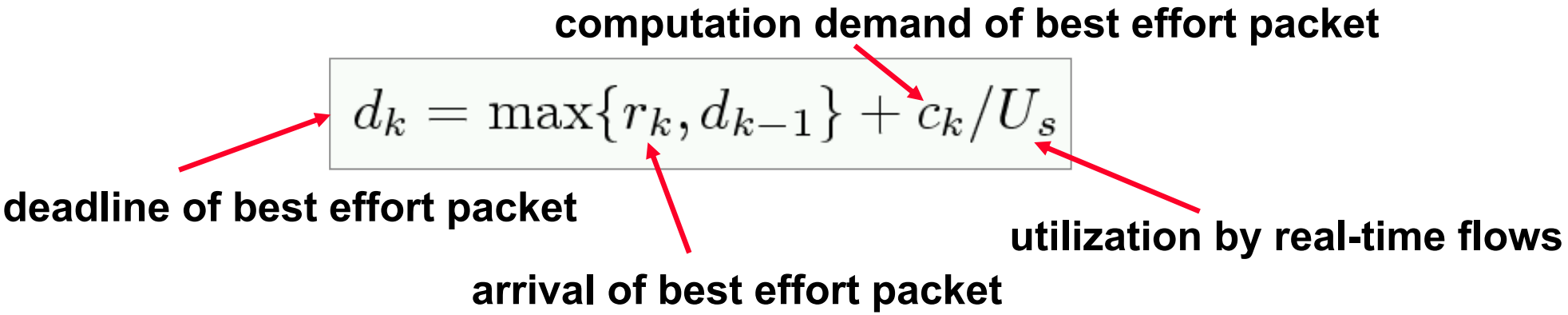
- First Schedule RT, then BE (background scheduling)
  - Overly pessimistic
- Use ***EDF Total Bandwidth Server***
  - EDF for Real-Time tasks
  - Use the remaining bandwidth to server Best Effort Traffic
  - WFQ (weighted fair queuing) to determine which best effort flow to serve; not discussed here …

CPU Scheduling



CPU Scheduling

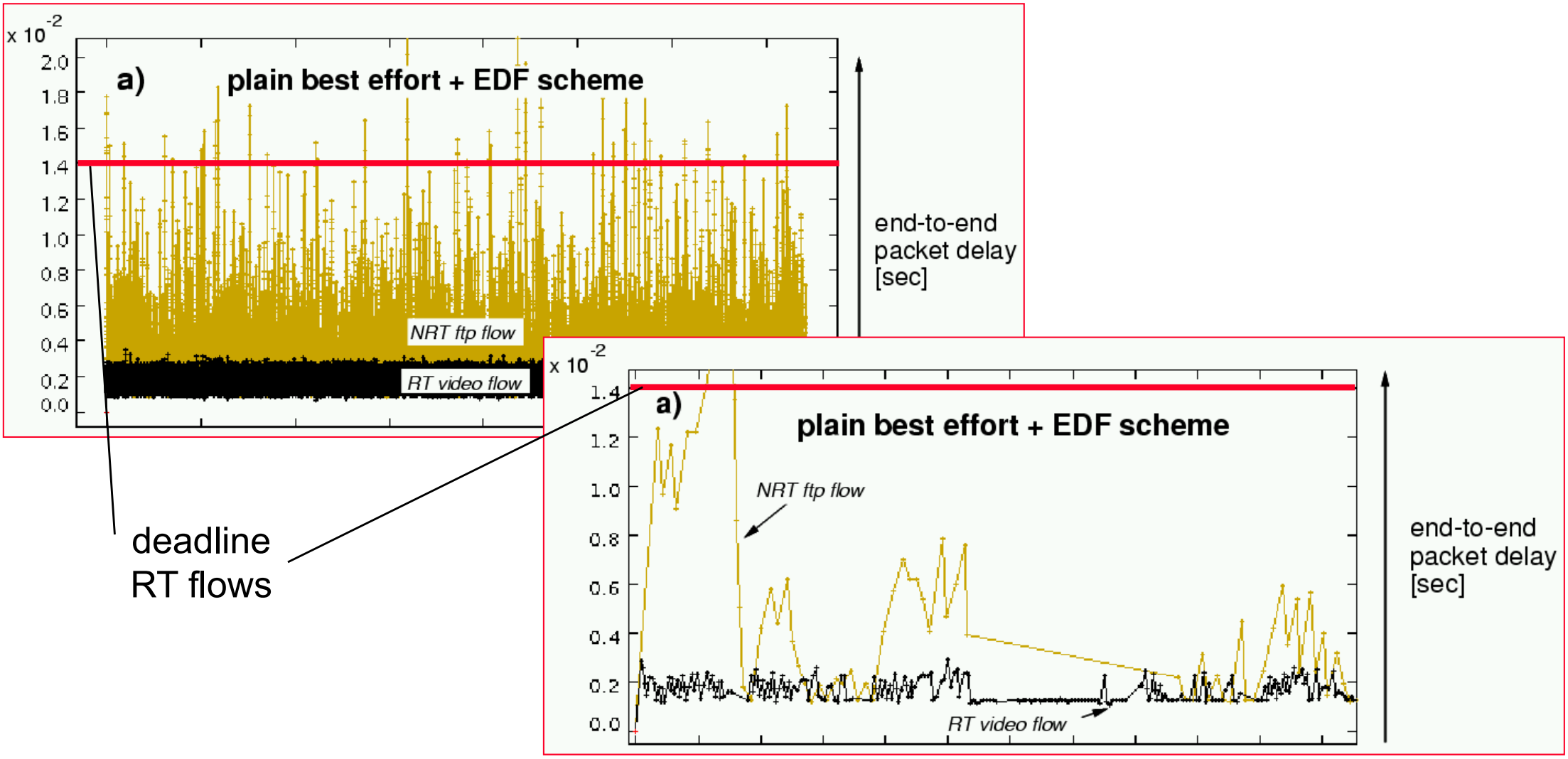
- As discussed, the ***basis is the TBS***:



- ***But***: utilization depends on time (packet streams) !
  - Just taking upper bound is too pessimistic
  - Solution with time dependent utilization is (much) more complex – BUT IT HELPS …

CPU Scheduling

- Before



CPU Scheduling

- After