IEEE 802.17 RPR

Some issues to be considered

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Content

- Application areas
- Traffic classes
- End-to-end delay
- Fairness
- Different link speeds on same ring
- Functions above MAC
- Features of recently specified dynamic metroring

Application areas

- **In-house and campus networks**
  - SDH: 155 Mbit/s, 622 Mbit/s, 2.5 Gbit/s ; GbE: 1 Gbit/s
  - Big market

- **Metro-networks**
  - SDH: 2.5 Gbit/s, 10 Gbit/s ; GbE: 1 Gbit/s, 10 Gbit/s
  - WDM technology
  - Big market

- **Regional networks**
  - SDH: 2.5 Gbit/s, 10 Gbit/s, 40 Gbit/s ; GbE: 1 Gbit/s, 10 Gbit/s
  - WDM technology
  - Reasonable market

- **Wide-area networks**
  - SDH: 10 Gbit/s, 40 Gbit/s ; GbE: 10 Gbit/s
  - WDM technology
  - Small market

Traffic classes

Three traffic classes on the ring:

- Premium class (circuit emulation): guaranteed throughput, tight delay jitter
- High-priority packet switching: guaranteed throughput, bounded delay jitter
- Low-priority packet switching: best-effort

Further QoS traffic classes above MAC

Type of traffic

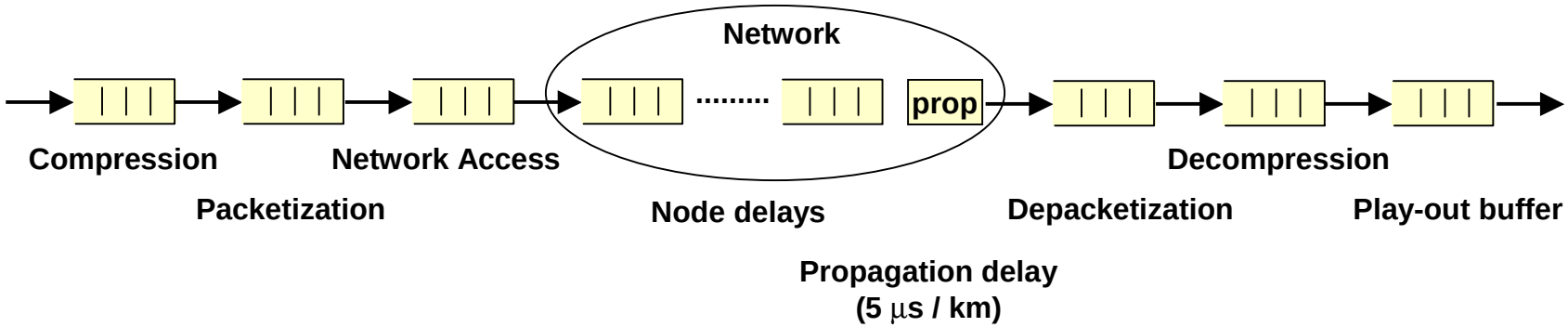
- Today: TCP-traffic dominant
- In future: shift to UDP-traffic (Voice-over-IP, multimedia-over-IP, high-speed applications with rate-control instead of window control)

Packet retransmissions

- no packet loss on ring, rejections only at the ingress nodes

End-to-end delay

End-to-end delay components



End-to-end delay requirement

- 80 ms allows natural interactive communication
- 100 -120 ms is tolerable
- Above 200 ms becomes cumbersome

End-to-end propagation delay determines remaining time of all delay components

Size of play-out buffer is given by maximal delay jitter

Global versus local throughput fairness

Assumption

All nodes have equal access rights and have always a packet to transmit

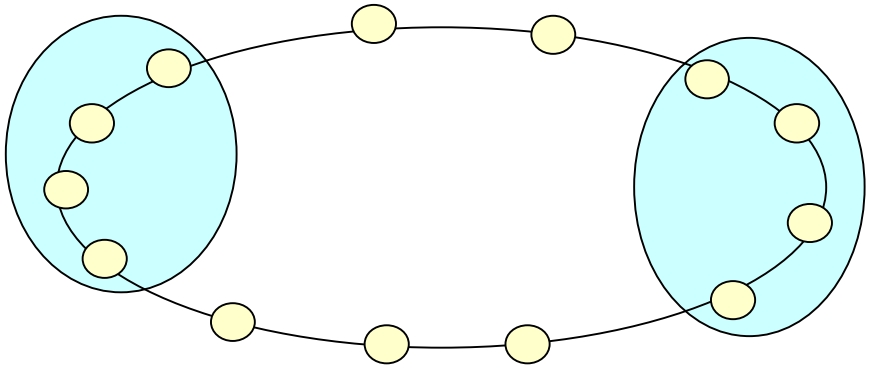
Global fairness

All nodes on ring obtain same throughput, independently whether they interfere or not

Local fairness

Fairness coordination is only between those nodes that use the same links for their packet transfers. Therefore, all nodes that do not interfere are not throttled in their performance

Different link speeds on same ring



High traffic area with higher speed links

High traffic area with higher speed links

- Local fairness mechanism with link state information is able to cope with this ring topology
- Options for protection mechanisms
  - Ring-wrapping at lowest link speed, additional line protection for higher speed links
  - Steering of traffic

Functions above MAC

- **Arbitration of additional QoS classes**
- **Routing and bridging**
- **Node network management**

Recently specified dynamic metroring (1)

- Single, dual or multiple ring topologies with shot-cuts where appropriate
- Combined packet, cell and circuit emulation
- Handling of asymmetric traffic flows
- Combined single and multcast operation
- QoS handling of flows with respect to throughput, delay and system availabilty
- No packet loss on the ring
- No packet loss due to destination port blocking
- Complete dynamic use of the bandwidth on each link of the ring
- Three traffic classes on the ring: SYN, ASYN1 and ASYN2
- Slotted transmission structure with buffer insertion to handle variable length packets
- Destination removal of packets
- Preemptive hierarchy of the ring traffic classes on slot boundaries
- Further access right distictions within the tree ring classes are handled above MAC
- Inherently not more than 3 x 125 microseconds delay jitter for circuit emulation
- Guaranteed delay bounds for packet/cell switching of high-priority class

Recently specified dynamic metroring (2)

- MAC addressing scheme incorporates ring nodes and all ports attached to nodes
- Simple distributed set-up of circuit-emulated channels after one ring roundtrip
- No fixed position of the SYN-slots of a channel within the framing period of 125 µs
- Immediate reuse of unused SYN-slots by other nodes
- Automatic protection switching upon link or node failures
- Scalabity of performance and # of nodes/ports by paralell rings and node bypassing
- Links between nodes may use different technologies (e.g. Gbe, SDH)
- Links between nodes may use different bit rates
- Paralell rings may be multiplexed electronically (SDH hierachy) or optically (WDM)
- Designed for fast and efficient hardware implementations
- Possibility to combine low- and high-performance nodes