

Network Programming
TDC 561

**Lecture # 9: Reliable Multicast
Protocols**

Dr. Ehab S. Al-Shaer
School of Computer Science & Telecommunications
DePaul University
Chicago, IL

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Agenda

- * Midterm Exam (review), Demo Sched.
- * Reliable Multicasting
 - concept and examples
 - RMP 1.3 b: operation and example
 - Advanced application (HiFi)
 - Independent studies
- * Techniques for Network Programming
- * Deadlock and Starvation in Network Prog.

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**Reliable Transport Multicast
Protocols**

- * What is "Reliable"?
 - Loss Recovery (for all members?)
 - ordered Delivery
 - No Duplicates
 - Isolating Independent failures
- * What is "Transport"?
 - ISO and Internet Transport layers
 - No Network layer support is expected
 - End-to-end Reliability
- * Which "Multicast"?
 - IP Multicast proposed in RFC 1112

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TRMP:Token-ring Multicast Protocols

- * Basic Concept
 - Token site is responsible for ACK
 - Ack (timestamp) is multicasted for total ordering
 - Next token-site must have all previous packets
- * Avoid Ack-implosion: only token-site Acks
- * Avoid Nack-implosion: Receivers send NACK to the token-site
- * Bounded Buffering: memory release after a message gets “stable” (token cycles)

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TRMP:Token-ring Multicast Protocols (Cont.)

- * Retransmission is unicast (Nack-response-avoidance)
- * Advantages of Token-Ring:
 - Message stability (all receivers got it)
 - immediate delivery (QoS=just reliable)
 - delayed delivery (QoS=total ordering)
 - Limit the buffering requirements
 - Distribute the retransmission overhead
 - Crash recovery (resiliency)
- * Examples: Reliable Multicast Protocol (RMP)

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RMP Error control Mechanism (Cont.)

- * NACK Mechanism in RMP 1.0
 - unicast NACK to token-site (NO implosion avoidance)
 - unicast NACK response: takes O(Receivers)
- * NACK Mechanism in RMP 1.3b
 - SRM request/repair NACK randomization
 - Implosion avoidance (NACK, reply)
 - Token-site ACK instead of “periodic polling”

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RMP 1.3b Flow Control Mechanism

- * TCP-like Flow Control!
 - Round-trip-time variance estimation
 - slow start
 - Dynamic window sizing on congestion
 - exponential retransmission timer backoff
- * Sender and Token-site Flow Control only
- * Any NACK Reduces the Sender Window too!!

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Examples of Reliable Multicast Protocols

- * SRM: Scalable Reliable Multicast (UCB)
- * RMP: Reliable Multicast Protocol (UWV)
- * TMTP: Tree-based Multicast Transport Protocol (UK)
- * SCE: Single Connection Emulation (GaTeck)
- * RMTP: Reliable Multicast Transport Protocol (AT&T)
- * Horus: Cornell university /Ken Birman
- * Log-based Multicast Protocol (Stanford)
- * LORAX: UCSC
- * MTP-2: Multicast Transport Protocol (RFC1301)
- * RAMP: Reliable Adaptive Multicast Protocol (RFC1458)

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Application-layer Reliable Multicast Server

- * **RMS Extended Group Communication Services**
 - Group Communication Fault Recovery
 - Inter-Protocol Multicast Communication
 - Extended Protocol Services
 - Selective Re-transmission
 - Dynamic Group Masking
 - Simple Declarative API
 - Extended Group Management Service

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