Internet of Things
IO 4041

Mid II syllabus

Application Layer: CoAP

- Overview, features, terminology
- CoAP vs HTTP
- CoAP messages, messaging model, message format

Slides + related concepts from “CoAP specifications RFC 7252”

Transport Layer: General overview

- Overview
- UDP: overview, checksum
- TCP: overview, TCP connection, TCP segment size and structure (header length, receiver window, seq # , ACK #), RTT and time out, duplicate ACKs, doubling the TO interval, fast retransmit, flow control, congestion control mechanism and its components (slow start, congestion avoidance, fast recovery)

Transport Layer: smart objects

- UDP for smart objects: overview, benefits, drawbacks
- TCP for smart objects: challenging properties
- limiting factors in severe resource constraint for TCP implementation
- A transport layer protocol for WSNs: Reliable Multi-Segment Transport (RMST)
  - Directed diffusion protocol
  - Features
  - No caching and caching modes

Slides + MB Chapter 6 Sec 6.1, Sec 6.2, Sec 6.3, Sec 6.4

Network Layer

IPv4

- basic idea of classes, subnets, addresses (network, broadcast, valid hosts, subnet mask)
- datagram structure: concept of each field
- Fragmentation and reassembly
- NAT

Slides + MB Chapter 4 (Sec 4.3, Sec 4.4)

IPv6

- Overview, key functionalities, changes from IPv4
- Transition from IPv4 to IPv6: tunneling\
- Continue on next slide

Network Layer

IPv6

- Header structure: concept of each field
  - Next header and related extended headers
  - Fragmentation process
- Addressing architecture: unicast (local and global), anycast, multicast

Slides + MB Chapter 15 (Sec 15.1, Sec 15.2, Sec 15.3, Sec 15.10

Adoption layer: 6 LoWPAN

- ZigBee, Bluetooth, IEEE 802.11: basic overview
- IEEE 802.15.4 standard
  - overview, characteristics
  - Device types, topologies, header size problem

6LoWPAN adoption layer

- Basic overview, connection with IEEE 802.15.4, route over, mesh under
- Services: Packet fragmentation and reassembly, Header compression. Link layer forwarding with multi-hop
- Supported Headers: A mesh addressing header, The fragment header, and The IPv6 header compression header

Slides + MB Chapter 16 Sec 16.1, Sec 16.2 (till page 237)

Wireless Sensor Networks (WSNs)

Definitions: sensors, sensor nodes, wireless sensor network

- WSN Characteristic, hardware architecture of a sensor node, infrastructure vs ad hoc
- Data dissemination: single hop vs multi-hop
- WSN architecture: flat vs hierarchical

Ad hoc routing protocol

- idea pf proactive link state algo
- Reactive DSR: route discovery: RREQ, RREP with examples
- DSR route maintenance: RERR example
- Idea of collision
- Action by nodes upon receipt of any kind of message
- data delivery, DSR optimization (route cache: use, benefits)
- Duplication of route hops, packet salvaging. RREP storm, hop limits, route shortening (route optimization), pros and cons