

IPv6 over Low power WPAN WG (6lowpan)

64th IETF

Vancouver, BC, CA, November 7, 2005

Chairs:

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6lowpan@IETF64, 2005-11-07

- **We assume people have read the drafts**
- **Meetings serve to advance difficult issues by making good use of face-to-face communications**
- **Be aware of the IPR principles, according to RFC 3979**

- ✓ Blue sheets
- ✓ Scribe(s)

64th IETF: 6lowpan WG Agenda

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Open Milestones (from WG charter page)

- **Mar 05** draft-ietf-6lowpan-problem: WG last call
- **Apr 05** draft-ietf-6lowpan-problem ⇒ IESG
 - Informational
- **May 05** draft-ietf-6lowpan-format: WG last call
- **Jul 05** draft-ietf-6lowpan-format ⇒ IESG
 - Proposed Standard
- All are 🙅 *late* 🙅
- We are not chartered for work beyond this

6lowpan Wiki

- <http://6lowpan.tzi.org>
- **Read: Everyone**
- **Update/Create: AuthorGroup**
 - Send mail to cabo@tzi.org to get in there
- **Your changes are welcome**
 - If we really don't like them, we'll revert them :-)
- **Gives us a chance to compile material that will be useful for next steps**
 - Of course, mailing list is better for actual discussion

What we need to do today

1. Work on **finishing our core documents**
2. Discuss future work
 - Figure out **whether it impacts our core documents**
 - Plan for a Rechartering **once core documents are done**

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6LoWPAN Overview, Assumptions, Problem Statement and Goals

Nandu Kushalnagar
Intel Corp

Gabriel Montenegro
Microsoft Corp

Notables brought up in mailing list

- **IP Node requirements applicability for 6LoWPAN**
 - IPsec issue
- **Discovery and control of 6LoWPAN devices critical**
 - XML too bulky

Goals not currently in charter

- **Simple discovery and control protocol for LoWPAN devices**
- **Adaptation of network management technologies for 6LoWPAN**
- **Specify threat model for 6LoWPAN devices**

Status

- **Draft mostly done**
 - **draft-ietf-6lowpan-problem-01.txt**
 - **Added security consideration section**
 - **Need a threat model for 6LoWPAN devices**
- **Next steps**
 - **Address any final comments**
 - **Submit to IESG?**

draft-ietf-6lowpan-problem-01.txt

- **Updates draft-ietf-6lowpan-problem-01.txt**
- **Editorial fixes**
- **New section: Security Considerations**
 - **Probably not sufficient**
- **Any comments?**

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Recent Changes on draft-ietf-6lowpan-format

**IETF 64 – Vancouver, 7 Nov 2005
Gabriel Montenegro – Microsoft**

Recent Changes (-00 to -01)

- IEEE 802.15.4 mode for IP
 - 16-bit short address support
- MTU – no changes
- Frame format and Adaptation Layer
 - datagram tag at 10 bits
 - protocol_type and datagram offset from 11 to 8 bits
 - reassembly timeout (15 sec)
- Stateless Address Autoconfiguration
 - support for 16-bit short addresses
- IPv6 Link-local Addresses – no changes
- Unicast Address Mapping
 - support for 16-bit short addresses
- Header Compression
 - slight wording changes because of Mesh Delivery Header
- Packet Delivery in a mesh
 - changed name to Mesh Delivery Field
 - added Originator link-layer address
 - changed wording to clarify this function
 - added appendix to explain other alternatives
- Security considerations - no changes

IEEE 802.15.4 mode for IP

- **added support for 16-bit addresses**
- **(new) PAN-specific broadcast**
 - **PAN ID included**
 - **short destination address: 0xffff**
 - **prevents bothering other PANs**
- **(new) relax the “MUST” on both src and dst link-layer address fields as per 802.15.4?**
 - **if src address is absent: sent by “controller”**
 - **if dst address is absent: sent to “controller”**

Frame format and Adaptation Layer (1/2)

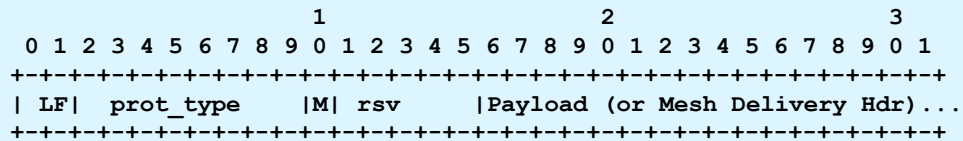


Figure 1: LoWPAN unfragmented encapsulation header format

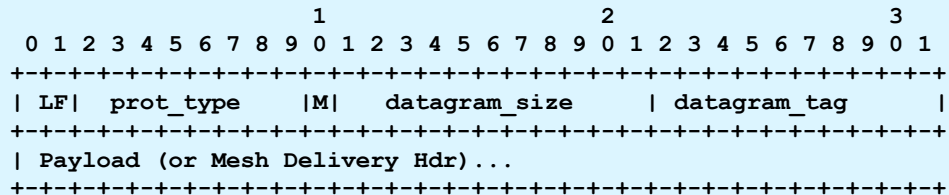


Figure 2: LoWPAN first fragment encapsulation header format

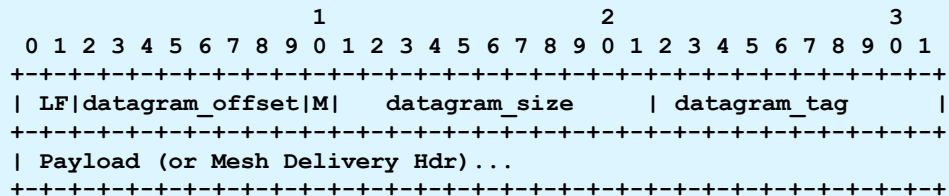


Figure 3: LoWPAN subsequent fragment(s) encapsulation header format

Frame format and Adaptation Layer (2/2)

- **larger datagram_tag**
 - from 7 to 10 bits
 - some concerns about rollover and tag conflicts
- **smaller protocol_type**
 - from 11 to 8 bits
 - 254 different types are still enough
- **smaller datagram_offset**
 - from 11 to 8 bits
 - count offsets in increments of 8 octets
- **(discussion) version field?**
 - is this necessary? no such field in similar low-level adaptation layers
 - 2 bits would be enough (obtainable from rsv and datagram_tag)
 - datagram_tag would reduce to 8 bits (still probably enough)

Stateless Address Autoconfiguration

- EUI-64 addresses for IEEE 802.15.4
 - Interface Identifier (IIF) obtained via IPv6 over Ethernet (RFC 2464)
- Prefix must be 64 bits
- **But also: mapping to 16-bit short addresses possible**
 - **pseudo 48-bit address:**
 - <32 zero bits>|<16-bit short address>
 - **IIF from IPv6-over-Ethernet**
 - Universal/Local bit to 0 (non-global)
- Link-local addresses as usual: FE80::IIF

Unicast Address Mapping

```
0                                     1
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
+-----+-----+-----+-----+
|   Type   | Length=2 |
+-----+-----+-----+-----+
|           |           |
+- IEEE 802.15.4 -+
| EUI-64      |           |
+-           -+
|           |           |
+- Address   -+
|           |           |
+-----+-----+-----+-----+
|           |           |
+- Padding   -+
| (all zeros) |           |
+-           -+
+-----+-----+-----+-----+
```

```
0                                     1
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
+-----+-----+-----+-----+
|   Type   | Length=1 |
+-----+-----+-----+-----+
| 16-bit short Address |
+-----+-----+-----+-----+
|           |           |
+- Padding   -+
| (all zeros) |           |
+-           -+
+-----+-----+-----+-----+
```

Packet Delivery in a Mesh

- clarified forwarding rules
- added appendix with extra discussion
- added Originator link-layer address
- TODO: Ascii diagram
- **New Mesh Delivery Field**

```

                                1           2           3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----+-----+-----+-----+-----+-----+-----+-----+
|S| Hops Left | Originator Address, followed by...
+-----+-----+-----+-----+-----+-----+-----+-----+
...Final Destination Address
+-----+-----+-----+-----+-----+-----+-----+-----+
```

draft-ietf-6lowpan-format-01.txt

- **Encapsulation was modified again:**
 - Old protocol type was 11 bits, new protocol_type 8 bits
 - Datagram tag now 10 bits
- **Reassembly**
 - Is 15 seconds reassembly timeout right?
 - Offset now 8 bits; is multiple of 8 right?
 - $102 - 4 = 98$; closest multiple of 8 is 96
 - What is the reassembly being keyed on?
 - Text says source, tag; what about destination, size?
- **Mesh delivery header now has originator address (always)**
 - Wastes bytes on first hop (which is likely to be battery operated)

draft-ietf-6lowpan-format-01.txt

- **Assumptions on address management?**
- **As a host address is either created out of the 64-bit address or out of the 16-bit address, the selection is visible to upper layers**
- **What is the role of the PAN ID? Is that likely to change?
Impact on stability of addresses?**

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draft-chakrabarti-lowpan-ipv6-nd-00.txt

- **Implicit assumption so far:**
 - We'll just use IPv6 Neighbor Discovery Protocol (NDP)
 - Solicitation/Advertisement, Unreachability Detection (NUD)
- **NDP was designed for Ethernet**
 - Heavy user of Multicast (☛ “solicited node multicast”)
- **802.15.4 only has Broadcast (expensive!)**
 - Star vs. Mesh
- **Draft: “Work in Progress”**
 - Change timers, define/use some special roles (coordinator)
- **Should this be in -format?**

draft-daniel-6lowpan-interopability-01.txt

- **Identifies the special tasks of an IPv6 router that interfaces to a LowPAN**
 - Some are rehash of -format (SAR, HC, Address Resolution)
 - Assumes we will use **16-bit MAC addresses**
- **Assigns 16-bit MAC addresses to **off-link** nodes**
 - Mapping expires after ET (expiration time)
- **Needs **registration procedure** for address assignment**
- **Is this a **NAT**?**
- **Do we want to address **16-bit** MAC addresses?**

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Zigbee and 6lowpan Interoperability

**Geoff Mulligan
Invensys**

**64th IETF
Vancouver**

Zigbee

- **Zigbee is an membership based alliance of companies**
- **Zigbee 1.0 specification published**
- **Defines a network and application stack running on 15.4**
- **IPv6 task group defining an stack profile to run IPv6 over a zigbee network**
- **WiFi -> 802.11 :: Zigbee -> 802.15.4 (but more)**

Two potential conflicts

- **Network frame format**
 - Zigbee's Network frame
 - 6lowpan adaptation layer
- **Beacon payload**
 - Defined within Zigbee
 - Currently undefined in 6lowpan

What is Zigbee network format

- **I can't say**
- **Specification is published**
 - **@ www.zigbee.org**
- **Possibly encumbered by IPR**
- **Have asked alliance for determination**

What is a beacon payload

- **“I thought we had specified a non-beacon network”**
- **Beacons are used to locate and identify PANS**
- **Join process**
 - **Active scan**
 - Send beacon request
 - Receive beacon response
 - **Send associate request**
 - **Receive associate response**
 - **Send / Receive data**

Beacon Payload

- **Within the beacon (response) is an opaque beacon payload.**
- **Zigbee uses this to identify network profile type**
 - **Home controls, Commercial, IPv6, Cluster Tree**

Questions

- **How do we want to provide interoperability/coexistence?**
 - **Frame format compatibility**
 - Change to format doc
 - **Beacon payload compatibility**
 - Define field for higher layer protocols
 - Part of format doc
 - New doc

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draft-chakrabarti-mobopts-lowpan-req-00.txt

- Radio-based topology is **not** constant
- Lowpan nodes may move from one PAN to another
 - Same or different IPv6 link
 - Communication should continue transparently
- PAN coordinators need to conspire
 - Moving node needs to authenticate to old and new PAN C
- PANs need to be identifiable
- Is a LowPAN a PAN or an internet of PANs?
- Which kinds of mobility do we handle?

draft-daniel-6lowpan-hilow-hierarchical-routing-00.txt

- **Routing Scalability by hierarchical routing**
 - Forward in tree
- **Assignment of 16-bit identifiers to reflect hierarchy**
 - Tree building during registration with parent
- **Unclear: Address Stability, Single Point of Failure**
 - Recovery process “TBD”
- **Do we need 16-bit addresses and hierarchy?**

draft-daniel-6lowpan-load-adhoc-routing-01.txt

- **Updates draft-montenegro-lowpan-aodv-00.txt**
- **Simplified version of AODV**
 - **FFD only**
- **Not in WG scope right now**
- **Existence proof (?) of flat routing**
- **No implications on -format (?)**
 - **But what about RFDs?**
 - May need proxying/registration

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draft-daniel-6lowpan-sslp-00.txt

- **Simplified version of SLPv2 for service discovery**
 - **User Agent (UA), Service Agent (SA), Directory Agent (DA)**
- **Translation Agent (TA) translates SSLP ↔ SLPv2**
 - **Removes/adds IP/UDP headers, simplifies SLPv2 header**
- **Not in WG scope right now**
- **No implications on -format (?)**

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Which of these do we have to do before we can finish -format?

- **ND fixes**
- **RFD/FFD, device roles**
- **16-bit addresses, hierarchy**
- **Routing interface**
- **Pan ID/Pan coordinator selection**
- **[]**
- **[]**

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