Radio over Ethernet
Considerations

Jouni Korhonen / Broadcom
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RoE Considerations

- **Use cases:**
  - Aggregation
  - Native RoE

- **Two modes to support:**
  - Structure agnostic -> encapsulate an opaque data blob and transport it.
  - Structure aware -> know the type of the transported stream/flow.

- **Mappers:**
  - How does e.g. CPRI (up to v6.1) map to RoE structure aware mode?
Use case examples
Use cases

- **Hybrid**
  - Legacy format converted to RoE within the system
  - Requires a mapper

- **Native RoE e2e**
  - No mapping
  - System supports RoE in all parts
Aggregation

- Requires only one mapper on radio side
- System + transport support RoE
Design decisions to discuss
Encapsulation modes

- Two choices..
  - Structure agnostic
  - Structure aware

Nevertheless.. the encapsulation header should be the same for both modes..
Native RoE Encapsulation format
- Minimal header -> 32 bits base header should be enough per packet.
- Number of “basic frames” per Ethernet packet -> small Ethernet packets -> large overhead.
- Number of supported antenna carriers per system.
- Number of antenna carriers per RoE packet. (thinking: switching becomes hard if more than once carrier per packet..)
- Size of a “basic frame”. 
Division of information in the RoE Header vs. Ethernet Header vs. OOB negotiation:

- How much can be assumed to be negotiated between the RE and REC out-of-band (OOB)? It makes no sense to transport static fields all the time.
- What information MUST be in every RoE packet header?

Link configuration management:

- What protocol / configuration could be used for “OOB negotiation”? How is this handled/managed?
- What information can be assumed to be derived from EthType/MAC addresses/TAG/VLANID etc?
- Sample size negotiation? Other than radio sample flow negotiation?
- Done when? Possibly during the link setup/sync phase?
- **Ethernet packets:**
  - What is included? Also TPID+TCI all the time (VLANs, PCP, ..)?

- **RoE encapsulation format:**
  - 32 bits base header per Ethernet packet. Assume that in some cases the header may grow.

- **Timing & Sync:**
  - Count for 1588 packets sent over the same transport as the RoE traffic.

- **Number of flows:**
  - RoE flows, C&M flows, Vendor specific flows.
  - All they contribute to the total overhead...
Transport assumptions

- How much can be squeezed into 2.5/5/10/25/..../100Gbps Ethernet links?

- Which flows are time-sensitive and which not?

- What are required from the transport / switching to ensure timely delivery of RoE packets?
  - What 802.1 tools we got to enforce this?
The RoE Header / Encapsulation
Assumptions..

- Minimal size. Proposal for 32 bits for the base.
- Should be usable outside Ethernet as well. Verify whether the header would be usable as-is with other transports as well.
- Identify MUST HAVE information in the header.
- How is the payload content length calculated (example: basic frame size is known priori, header size is fixed, and the Ethernet packet size is learned during reception)?
- Same header used for both structure agonistic and aware modes.
Strawman proposal: the RoE Header

- Bits 31-28 -> set all 0.
- Bits 27-23 -> Packet Type; 32 types available.
  - One value reserved for Structure Agnostic payload.
  - One value reserved for future extensions.
  - Some types may include additional headers.
- Bits 22-16 -> Flow ID; 128 available.
- Bits 15-0 -> Sequence Number.
  - How the SN is actually constructed??
- Btw.. The above suddenly resembles PWE CW..
Strawman proposal: the flows

- The RoE does not really need to understand the data it carries beyond the type and time sensitiveness.

- Each flow in separate RoE packet:
  - Easier (and more compact) to construct.
  - Each flow can be switched individually!
The mapper
Example of a CPRI (v6.1) mapper to the native RoE format:
- 1:1 translation is challenging.
- Not all information in the CPRI Hyper Frame and Basic Frame is needed...
- Which information of CPRI framing is MUST to translate back and forth to RoE?
Strawman proposal: Mapper

- Radio flows:
  - I/Q data.. Any sample size etc..

- C&M flows:
  - Fast C&M is Ethernet already..

- What about ctrl_AxC data?
  - Opaque data flows to mapper..

- What about vendor specific flows?
  - Opaque data flows to mapper..

- And then L1 protocol..?
  - Terminated locally?