Next Generation IEEE 802 Time Synch:
IEEE 802.1ASbt
– or –
IEEE 802.1AS Revision

**Michael D. Johas Teener**

**Sr. Technical Director /
Plumbing Architect
Broadcom Corporation**

Agenda

- **What is 802.1AS?**
- **What needs to be finished?**
- **What would we like to improve?**
- **Time synchronization unification**
- **Schedule & status**

IEEE 802.1AS is …

- **… both a subset and superset of the IEEE 1588 "Precision Time Protocol"**

  - … a *profile* of 1588 for layer 2 Ethernet
    - a much simplified subset
    - compatible enhancements for much faster clock locking and easier/lower cost filtering at endpoints

  - … but a *superset* of 1588v2 to support 802.11 WiFi, EPON and "coordinated shared networks"

802.1AS connectivity
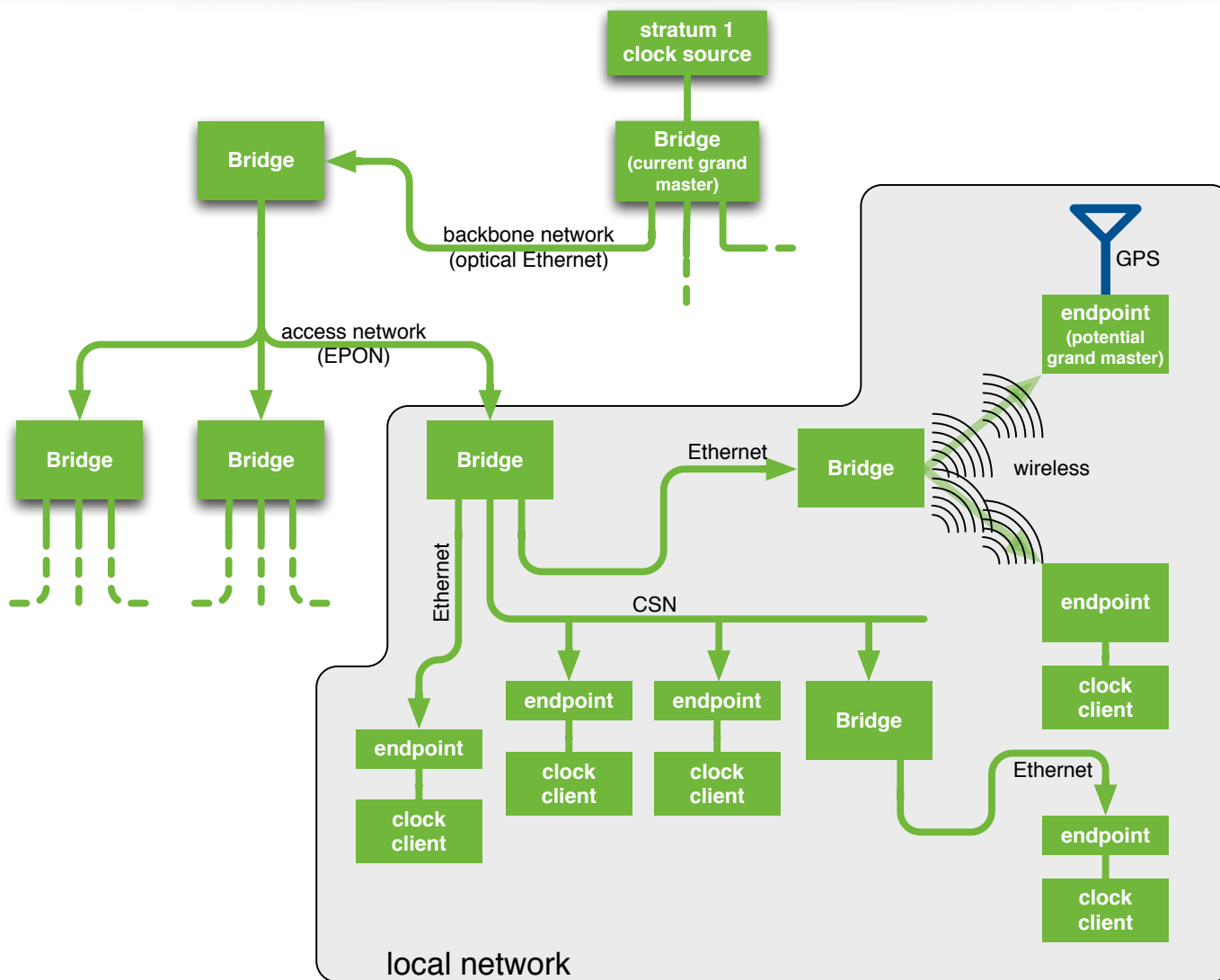
Architectural model

IEEE 802.1ASbt
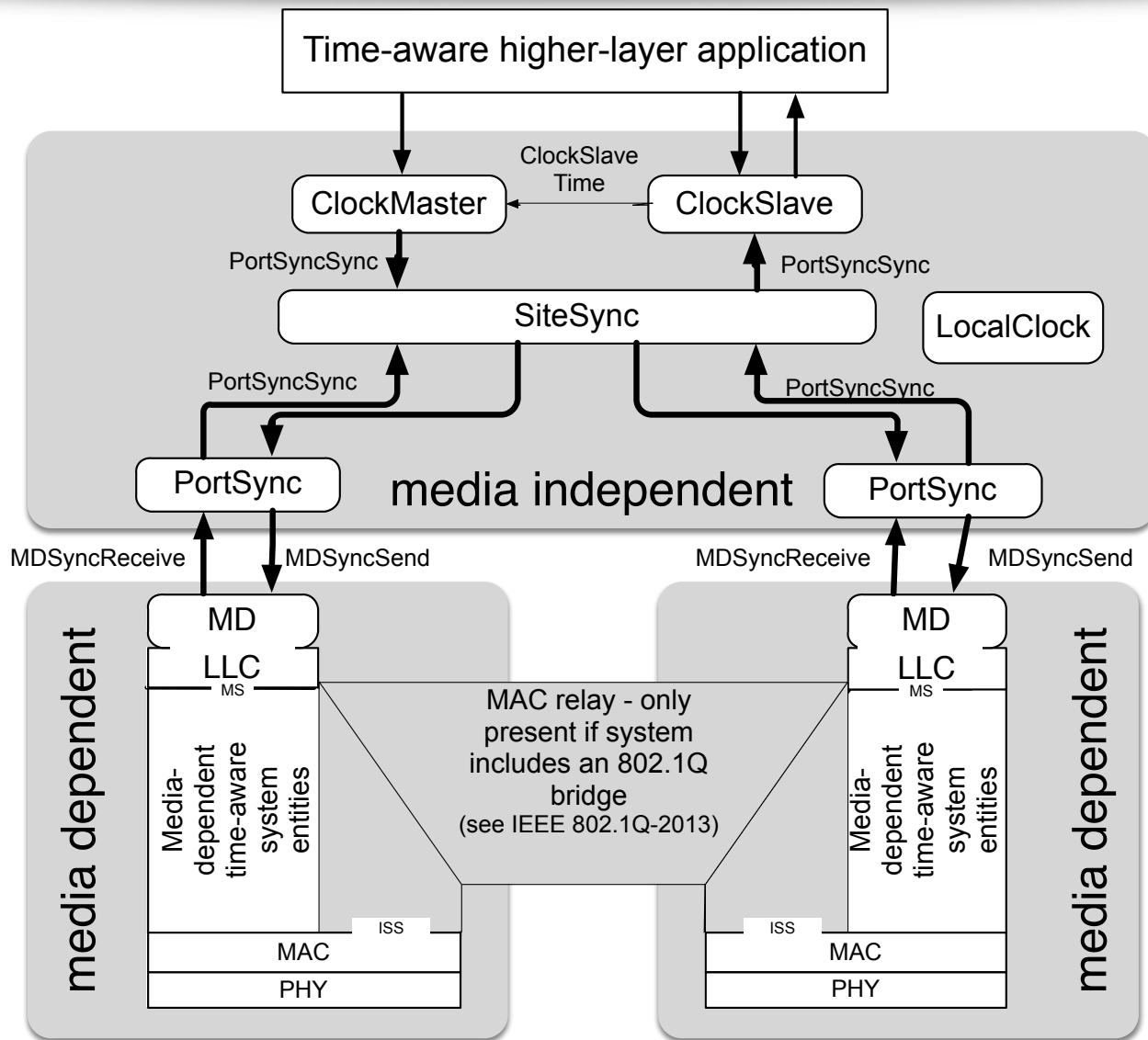
- **… is an amendment to 802.1AS for**
  - Enhanced link support
    - Support for *all* of Ethernet
    - Other layer 2 links of interest
  - Improve performance and usability
    - Responsiveness and reliablity
    - Scalable to larger / more difficult topologies
  - Enable protocol unification
    - End the 1588 vs 802.1AS vs NTP confusion

Layer 2 compatiblity

- **Support for link aggregation (IEEE 802.1AX)**

- **Work with 802.3 on multi-lane timestamp reference point**
  - Help them improve the 802.3bf document

- **Support for other media:**
  - IEEE 1901, WiFi Direct, etc
    - (if changes are needed)

Improved scalability

- ## One step processing
  - Full spec for reception
    - Perhaps defer specification for transmission procedures
  - For both synch and peer delay
  - Fully backward compatible with two-step
    - Automatic detection of mechanism in use

- ## Improved support for long chains
  - large ring topologies in particular

More responsive

- **Faster Grand Master change over**
  - Pre select a failover Grand Master so the selection when needed is faster
  - Support both hot and cold standbys
- **Reduce BMCA convergence time/work for large (>64 node) networks**
  - Work to decouple BMCA from topology discovery and path selection
  - Allow use of alternate path discovery mechanisms
    - IS-IS for IP, 802.1Qca for layer 2
    - Direct "God box" management

Reliability

- **Redundancy**
  - Short reconfiguration w/redundant paths when one path fails
  - Multiple active Grand Masters for the same domain

- **Aid for measurement of link delay asymmetry**
  - "reverse links and remeasure"

- **Reliably detect buffered repeaters**
  - Need an alternate mechanism for long (fiber) links
  - MAC control frames?

Additional features

- **Multiple domains with synchronization information**
  - Domain 0 is PTP epoch only: "universal clock"
  - Domain 1-127 allowed, may use ARB epoch: "working clock"
  - Allow domains to share path delay and neighbor rate-ratio information

- **Accuracy reporting**
  - Each bridge to report its worst case Time Stamp accuracy
  - GM-to-ordinary-clock path "timing fidelity" reporting

Amendment -> revision

- **Current spec implies that 802.1AS is only implemented in 802.1Q bridges**
  - "Timing and Synchronization for Time-Sensitive Applications in _Bridged_ Local Area Networks"
  - Need to remove that "bridged" part since .1AS can be implemented by any device with 802 port(s)
    - Not just "bridges" … the MAC relay function is never used in 802.1AS

- **Also, "amendments" are ugly**
  - They are a list of editing instructions, not a new clean document,
    - But the 802.1ASbt project is adding a lot of words
  - The TSN task group decided a cleaner document was more useful
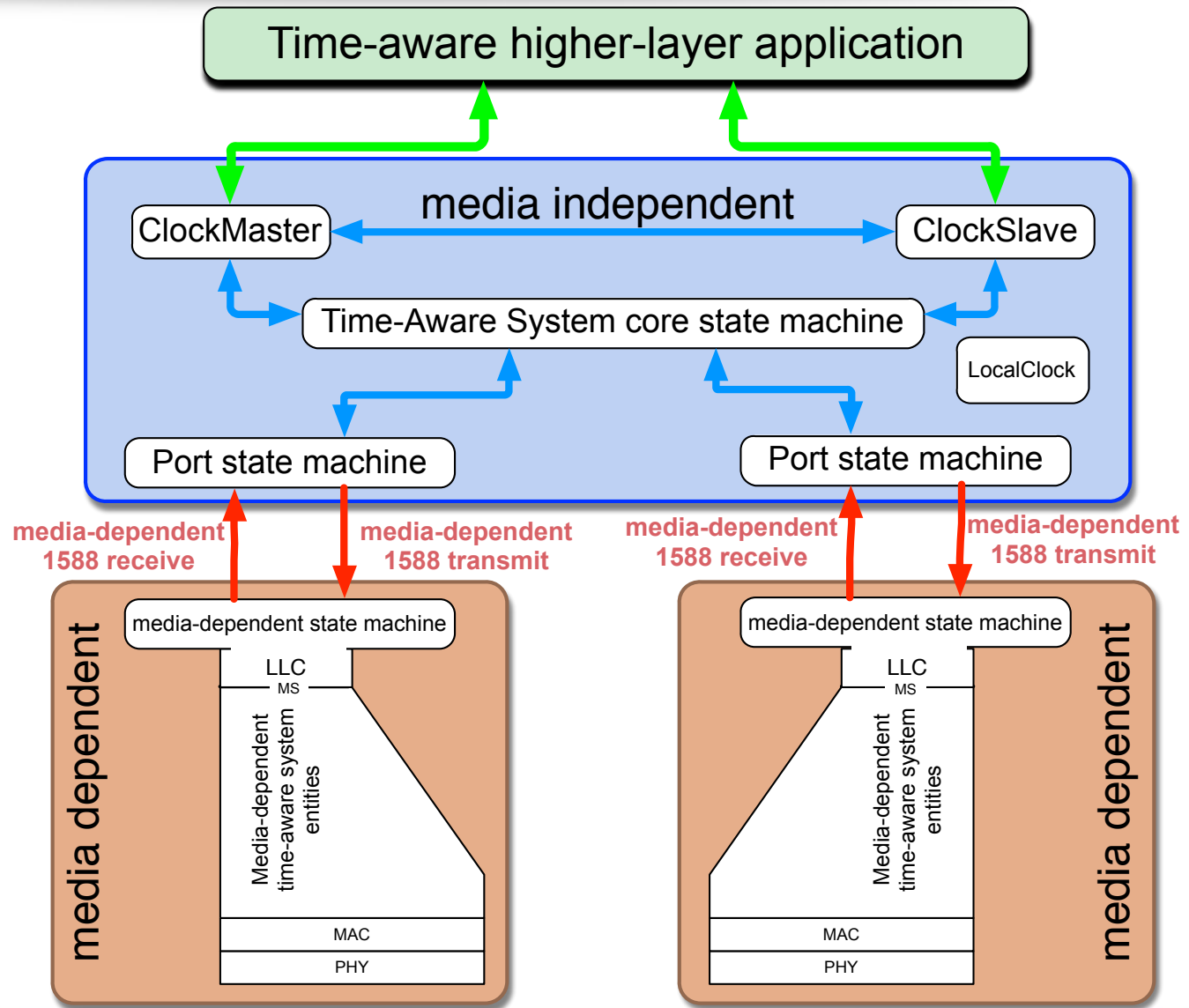
Next: protocol unification

- **Provide L2 timing information for 1588 revision**
  - Merge 802.1AS and 1588 architectures

- **Work with 1588 to provide end-to-end quality information**
  - Common service interface and information exchange

- **Move media-independent layer out of 802.1AS?**
  - Probably not in 802.1ASbt, but the next planned future revision
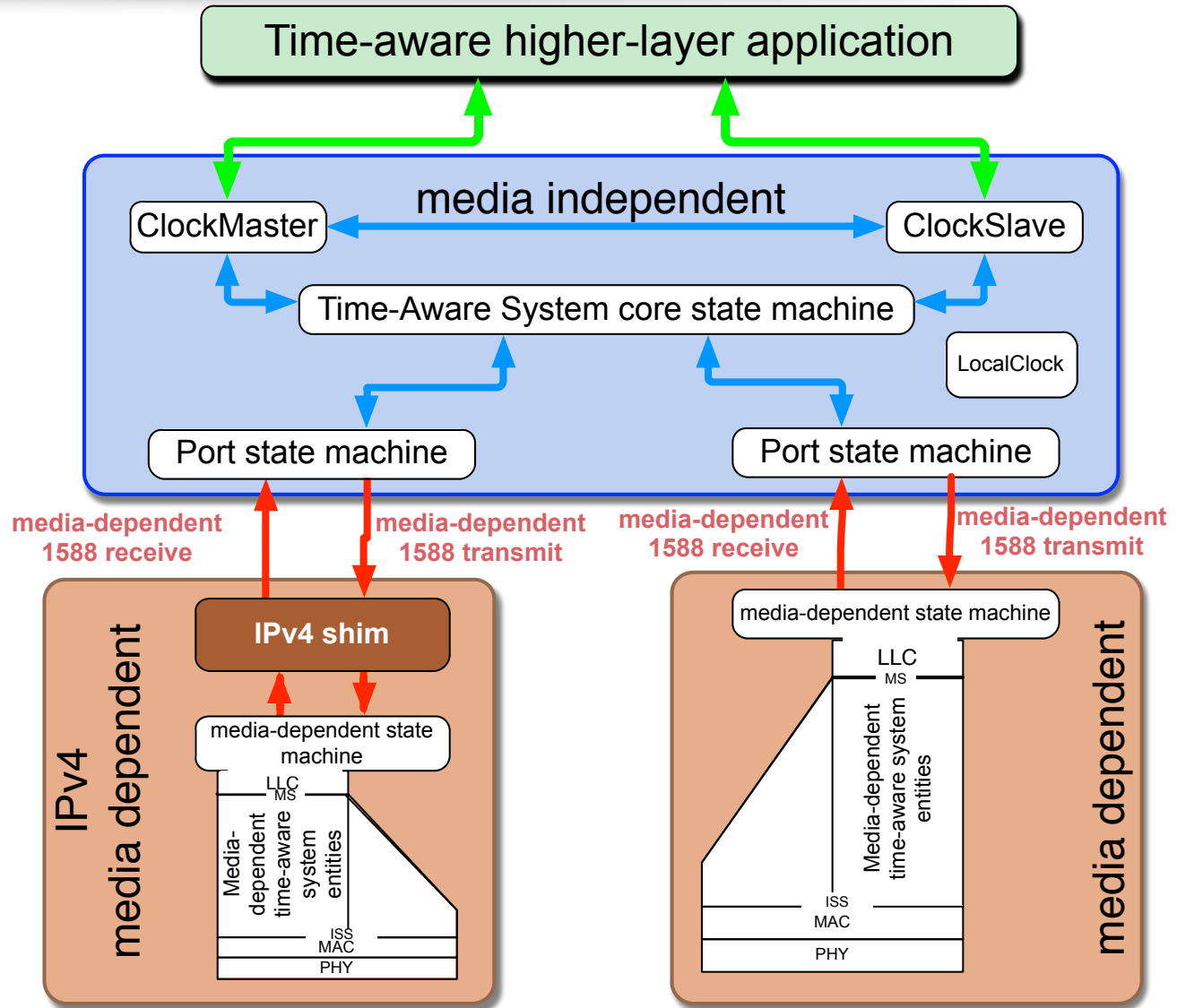
A unified architecture

- **802.1AS (future)**
  - Still a 1588 profile, but not a superset

Time-aware higher-layer application

media independent

ClockMaster — ClockSlave

Time-Aware System core state machine

LocalClock

Port state machine — Port state machine

media-dependent 1588 receive — media-dependent 1588 transmit — media-dependent 1588 receive — media-dependent 1588 transmit

media dependent

media-dependent state machine

LLC
MS

Media-dependent time-aware system entities

MAC

PHY

A unified architecture

- **Example universal time-transport system**
  - 802.1AS "leg"
  - IPv4 "leg"

Schedule and status

- ## IEEE 802.1ASbt "assumptions" list complete

  - Drafts 0.4 is current, next draft delayed to accommodate change from "amendment 802.1ASbt" to "802.1AS revision 1"

  - Continuing detail documentation of changes so technical progress is continuing

- ## IEEE 1588 coordination vital

  - Already thinking about assumptions list for IEEE 802.1AS revision 2 …

  - Getting ready for "universal time transport" system