Terminology for Constrained-Node Networks

# RFC 7228 bis

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# RFC 7228 (May 2014) need for update?

- Has the world moved?
- Is terminology missing?

# Power constrainedness

- Terminology such as E0 or P0 was added late to RFC 7228 — how successful is that?

- Are there “classes” for Ps and Et?

# Terminology for networks

- MTU-constrainedness (1500+, 500, 128, 27, 12, 8)
- millibit characteristics
- asymmetry (e.g., powerful base stations vs. constrained devices; powered mesh routers; …)
- mobility (building networks vs. BANs vs. Logistics)?

# Terminology for platforms

- J-class (J as in “Jeep”, GP) vs. M-class
- Higher classes within M-class (Class 3, 4)
  No subclasses (1a/b/c = 128/8, 128/16, 256/16)?
- Potential Other:
  - Crypto capabilities?
  - Protection capabilities (MPU, MMU, …; Kernel/User; TrustZone/Secure Element; tamper-proof…)?

| Group | Name | data size (e.g., RAM) | code size (e.g., Flash) | Examples |
|---|---|---|---|---|
| M | Class 0, C0 | << 10 KiB | << 100 KiB | ATtiny |
| M | Class 1, C1 | ~ 10 KiB | ~ 100 KiB | STM32F103CB |
| M | Class 2, C2 | ~ 50 KiB | ~ 250 KiB | STM32F103RC |
| M | Class 3, C3 | ~ 100 KiB | ~ 500..1000 KiB | STM32F103RG |
| M | Class 4, C4 | ~ 300..500..1000 KiB | ~ 1000...2000 KiB | "Luxury" |
| J | Class 10, C10 | 4-8 MiB | (?) | OpenWRT routers |
| | | | | |
| J | Class 13, C13 | 0.5..1 GiB | (lots) | Raspberry PI |
| J | Class 15, C15 | 1..2 GiB | (lots) | Smartphones |
| J | Class 16, C16 | 4..32 GiB | (lots) | Laptops |
| J | Class 19, C19 | (lots) | (lots) | Servers |

# New M-group classes

- C3: recognizable cluster above C2
- C4: pretty fuzzy

| | | | | |
|---|---|---|---|---|
| M | Class 0, C0 | << 10 KiB | << 100 KiB | ATtiny |
| M | Class 1, C1 | ~ 10 KiB | ~ 100 KiB | STM32F103CB |
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# New M-group classes

- Numbers for M-group classes now mostly assume execute-in-place (XIP) architectures
- Load-from-Flash architectures
  more difficult to describe:
  - RAM size (e.g., ~ 512 KiB)
    - partitioned into code/data/cache RAM?
  - Flash size — often 2..8 MiB (more than code)

# J-group classes (all new)

- Recognizable classes per product; gaps left (right gaps?)

- Code size vs. demand-paging (MMU!); XIP rare

| | | | | | |
|---|---|---|---|---|---|
| J | Class 10, C10 | 4-8 MiB | (?) | Limited Flash | OpenWRT routers |
| | | | | | |
| J | Class 13, C13 | 0.5..1 GiB | (lots) | Large Flash, SSD | Raspberry PI |
| J | Class 15, C15 | 1..2 GiB | (lots) | | Smartphones |
| J | Class 16, C16 | 4..32 GiB | (lots) | | Laptops |
| J | Class 19, C19 | (lots) | (lots) | | Servers |

# Criteria for class terminology

- Classes should exist in actual products
- Class boundaries should be indicative of capability boundaries
  - Laptop vs. Server?  Hmm.
- Can we collect **examples of speech** that employs classes?

# Proposed new classes: Levels of Software Update Capabilities

| | **Firmware/Software upgradability** |
|---|---|
| F0 | no (discard for upgrade) |
| F1 | replaceable, out of service during replacement, reboot |
| F2 | patchable during operation, reboot required |
| F3 | patchable during operation, restart not visible externally |
| F9 | app-level upgradability, no reboot required ("hitless") |

# Proposed new classes: Levels of Isolation Capabilities

| | **Isolation functionality** |
|---|---|
| Is0 | no isolation |
| Is2 | MPU (memory protection unit), at least boundary registers |
| Is5 | MMU with Linux-style kernel/user |
| Is7 | Virtualization-style isolation |
| Is8 | Secure enclave isolation |

# Proposed new classes: Levels of Secret Shielding Capabilities

| | **Secret shielding functionality** |
|---|---|
| Sh0 | no secret shielding |
| Sh1 | some secret shielding |
| Sh9 | perfect secret shielding |

# Proposed new classes: Strategies of Keeping Time over Power Events

| | Type | Uncertainty (roughly) |
|---|---|---|
| T0 | no concept of time | infinite |
| T1 | relative time while awake | (usually high) |
| T2 | relative time | (usually high during sleep) |
| T3 | relative time | $10^{-4}$ or better |
| T5 | absolute time (e.g., since boot) | $10^{-4}$ or better |
| T7 | wall-clock time | $10^{-4}$ or better |
| T8 | wall-clock time | $10^{-5}$ or better |
| T9 | wall-clock time | $10^{-6}$ or better (TCXO) |
| T10 | wall-clock time | $10^{-7}$ or better (OCXO or Rb) |

# The Plan

- Initiate Focused Discussions on the List
- “Topic of the Week” (after summer break)
- Solicit pre-WGLC reviews when this is completed
- Update once more; WGLC