Universal Power Adapter for Mobile Devices

IEEE Project 1823

Portable Power Delivery Convergence

Overview and Status

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P1823/UPAMD is a Working Group sponsored by the
IEEE Computer Society Microprocessor Standards Committee
George Riley, Chair

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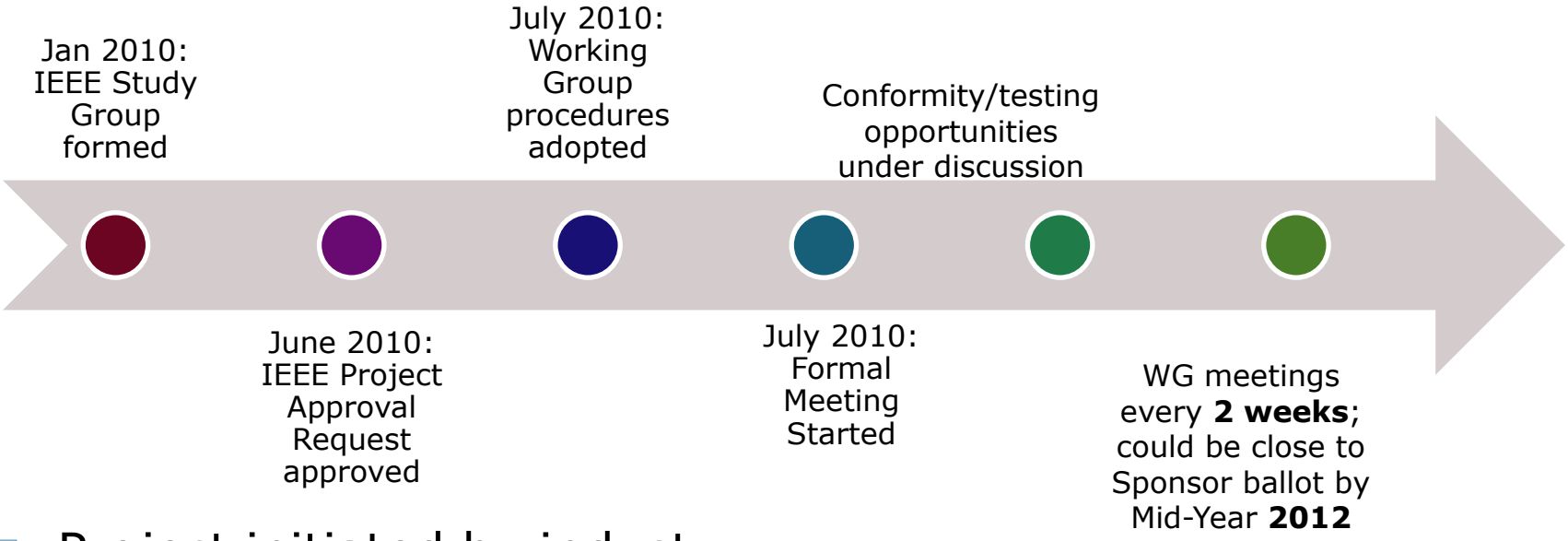
UPAMD/P1823 Purpose

- The UPAMD standard creates a common interconnect for power delivery greater than 10W and up to, but less than, 240W to portable and fixed devices. This standard supports more universal use and reuse of power adapters replacing brand specific and model specific power adapters. The UPAMD adapter system may be usable in portable computing and entertainment systems, security, household and office equipment within the power range. Universality and reuse are among the primary driving factors. Communications may support the adaption of the powered device performance to the power available.

IEEE Universal Power Adapter Project

- P1823, IEEE Draft Standard for Universal Power Adapter for Mobile Devices (UPAMD)



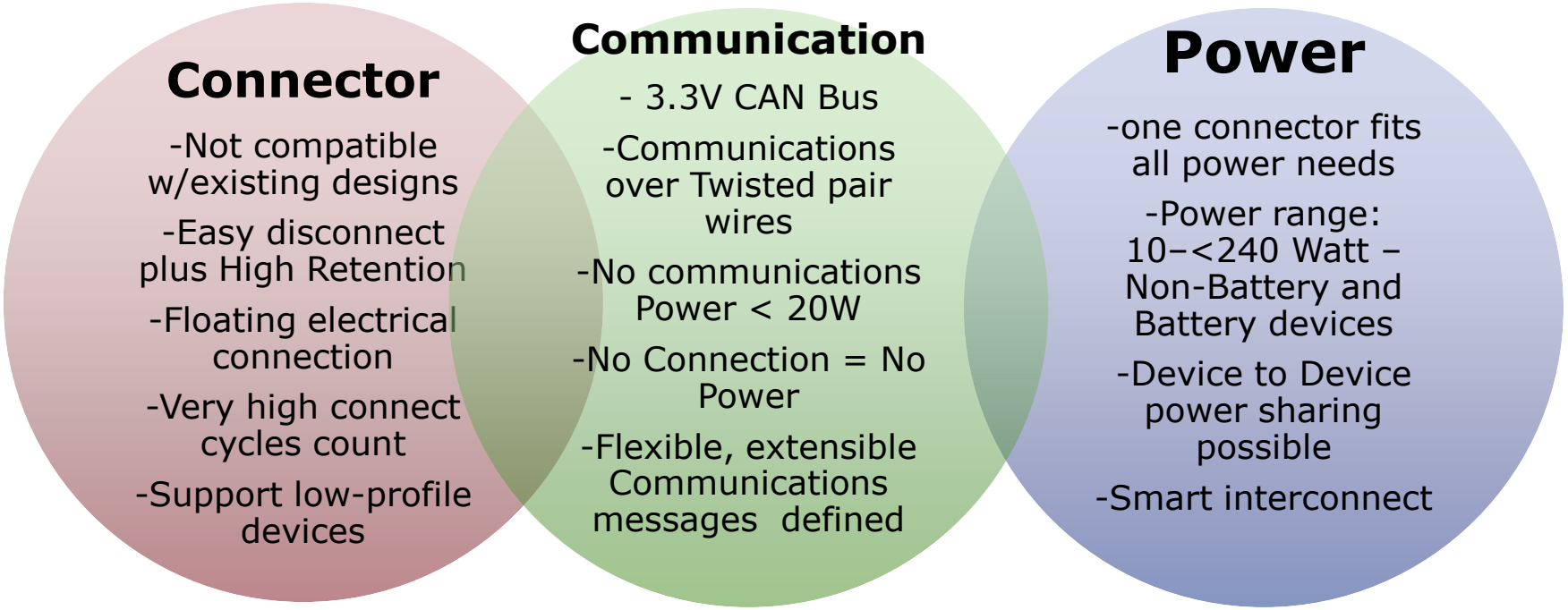
- Project initiated by industry
- 151 subscribers to project reflector (6 March 2012)
- Estimated 95% worldwide support (ODM & OEM)
- Main Working Group plus 4 Sub-committees every 2 weeks
- Open Meetings via Teleconference and WebEx

IEEE P1823: UPAMD Goals

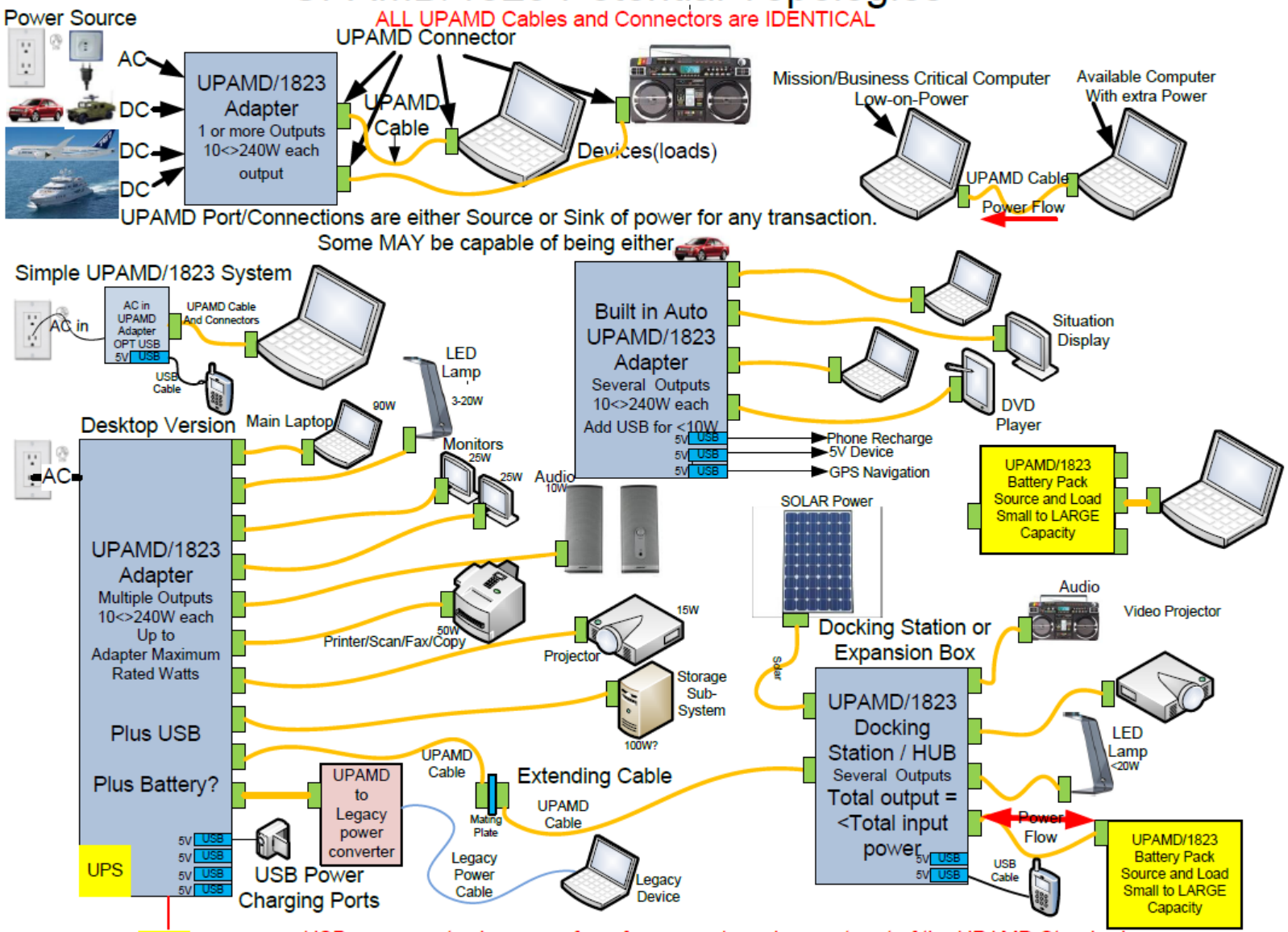
Web site: http://grouper.ieee.org/groups/msc/upamd/index.html

- Life expectancy minimum of **10 years**, hopefully much more
- Same connector for ALL device and adapter connections
- Power range **10 W<UPAMD<240 W** delivered to device; is brand, model, and year agnostic
- First adapter must work with last device designed and last adapter with first device designed. Standard compatibility.
  - **Adapter<->Mobile Device communications** required for higher power safety
  - Continuous communications growth to support growth of UPAMD capability
- Must support devices with, and without, internal battery power.
  - **Basic power delivery mechanism – EPS (External Power Supply)**
  - Make independent of rapidly changing technology
- Standard designed to support **Certification** testing of adapter and device
- Connector design to consider future mobile device design options
  - **Smaller profiles, headed for 10mm to 5mm?** Different shape devices, non-edge usage
- No significant power without communications
  - Maximum energy at cable connect and disconnect < 15uJ
  - Maximum exposed power on unconnected power source connector is <190 uW.
  - Maximum mute device power, connection detection only, is up to 20W
- Any Device may be capable of being a source or sink of power
  - Able to share power for mission critical or business critical applications
- **Connector must not mate with any current designs**–product safety issue–no confusion
- Environmentally friendly to eventual disposal

IEEE P1823: UPAMD Goals



UPAMD/1823 Potential Topologies



USB power ports shown are for reference only and are not part of the UPAMD Standard

Uninterruptable Power Systems (UPS) shown are for reference only and are not part of the UPAMD Standard

Power Specification (current)

- Power Range - >10W to <240W
  - >10 W to 130W at default 21V power at source
    - 130W power is delivered at 21 V and 6.5A.
    - Connector power pin current specification is 9 Amps each (redundant connections)
  - Sink (user) expects not less than 20V at input
  - Up to 240W with extended Voltage options
    - Sink may request higher voltage up to 60V iff source is capable of higher voltage
  - Power levels may change over time based on power available and device requirements
- Probe Power on CAN signal lines – 3.3V 5% through 20K Ohm
- Mute – Non-Communicating device
  - Have low value termination resistance for easy identification
  - Maximum power supplied is 21V with 1 Amp limit
    - Lower power requirements may use different termination – 21V with lower current
- Communications Power for start up of sink controller
  - 12V nominal (+/-10%) current limited to 25mA (300mW)
    - Low Energy connection – must stay under 15uJ maximum stored energy at connect and disconnect time.
    - Used to boot device controller and to initialize communications
    - Switch to higher voltage after communication established and power level negotiated

Communications - Basic

- Communication Method – 3.3V CAN Bus
  - Bosch CAN Version 2.0 1991 Protocol
  - Built into most modern very low cost embedded processors – ARM and others
- CAN Common Mode Voltage used for device detection.
  - No Device Detected – no power! (other than 81uw from probe power)
  - Mute Device Detected – limited power up to 21 W maximum, 21V @ 1A
  - Smart Device Detected – Negotiate Power based on source and sink capabilities.
    - Small power source may provide limited power with power sink adjusting to available power.
  - Bidirectional Device Detected – negotiate power flow based on priorities and capabilities of connected devices.
- Basic Messages
  - Initialization Message, sink to source on sink power up with UPAMD version, status, and minimum power needs.
  - Available Power Message, source to sink defining source capability on this port at this time.
  - Requested Power Message, sink to source with requested power
  - Messages to supply device information, Manufacturer, Model, Serial number, Unique Identifier, etc.
  - Message to identify certification

Communications - Advanced

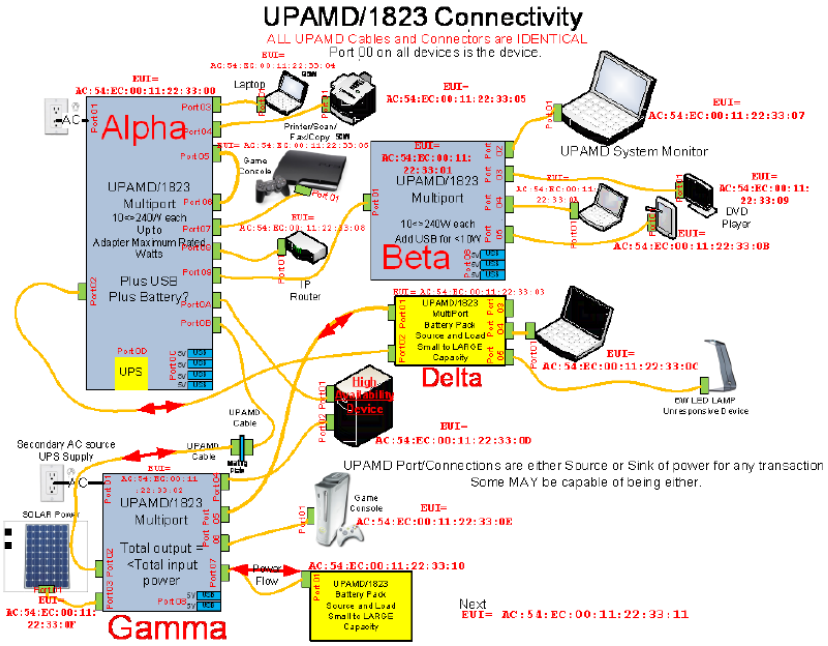
Advance Data Messaging is used to discover larger device configurations, if any, and enable communication through connected devices.

DATA messaging enables users to:

- Create a map of all devices
- Determine the version of each UPAMD device
- Find loops, and other misconnections
- Maintain a profile on power usage by device.
- Check if devices are tested, certified, legitimate
- Determine the location(s) of stored power
- Do high availability devices have TWO sources?
- IPv6 messaging throughout system
- Security and encryption messaging defined
- Other user developed operations

Control functions enabled by DATA messages:

- Reconfigure power flow
- Enable slaved power operation
- Supervise recharging of power storage
- Report power status to local and remote users
- Lights-out maintenance system management



Worse case configuration example - intentionally convoluted

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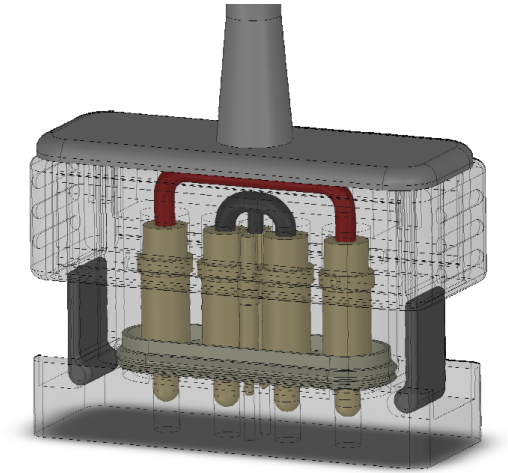
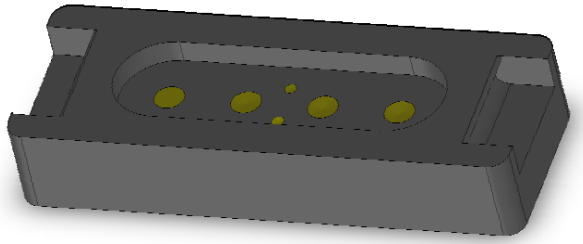
Connector Design (current)

- Current Design
  - Spring Pin(Pogo) connector
  - 6 pin – 4 wire design
  - Detachable cable has two identical ends
  - Cable replaceable with multiple lengths – 0.5 to 10 meters
  - SAE and USCAR Creating working group to interface with UPAMD
- Features
  - Pins rated for 1,000,000 cycles
    - Power pins – Mill-Max 0851 series or equal rated at 9-10 Amps
    - Communications pins – Mill-Max 0951 series, Yokowo, or equal
    - Dual Main power pins for reliability – full capability if one fails
  - Pin Spacing supports 63V creepage and clearance under Pollution degree 3. IEC60950-1
  - Communications pins make last and break first.
  - No exposed pin has more than 3.3V probe voltage through 20Kohm resistor
  - Cable connector interface only to device connector (TARGET) is specified
    - Two stage mating – one for trip resistant low retention easily detached position, one for hard attach condition for critical connections and connections subject to high acceleration.
    - Fluid resistant seal around connector
  - Device connector (Target) is fully specified.
    - Low profile – Flush with device surface.
    - Maximum surface penetration ~ 1.53 mm.
    - Very low cost connection – possibly PCB target
    - Surface can be sealed to resist moisture, dust, adult beverages, etc.

New UPAMD connector design



Cable Connector
Mating Interface Specified



Target/Device Connector
Fully Specified
19.5mm L X 5.1mm W X 1.53mm D

Cable/Connectors resistance limited to less than 50mOhms per power rail. 100mOhms total resistance

UPAMD Market Size

- US DOE survey of domestic US shipments result for 2010
  - 221.5 Million EPS units in UPAMD power range to US Domestic Market alone.
  - 302 Million battery charger in UPAMD power range to US Domestic Market alone.
    - Battery Charges have both EPS and Battery control circuitry
- World wide shipments should reach 2-3 Billion units of BCS and EPS devices in UPAMD power range.
- Current 2011 PC world shipments 354.4 Million units with 15.9% y/y growth. (iSuppli)
- Tablet market growth to reach 294 Million in 2015 (Gartner)
- Reference: http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/bceps_preanalysis_tsd.pdf

Still To Be Completed

- Draft cleanup, currently in process
- Balloting
  - Draft Balloting in working group
  - Draft Balloting by Sponsor (MSC)
  - Submission to IEEE SASB for approval
  - Forwarding to ISO/IEC under current IEEE/ISO agreement
- Interest group for high-speed link
  - Possible optical link to 10 Gb/s?
  - Must fit in current connector footprint
  - Probable target usage – 10Gb/s Ethernet
- Contributed comments to US DOE EPS/BC Rule Making
  - Results of comments not yet known – 1 July 2012 final ruling

UPAMD/P1823 Status

- Currently working to finish draft for balloting by working group.
- Expect Working Group after mid-year
- Plan on Sponsor Ballot in Q3-4/2012
- Target Standards Board submission in Q4/2012
- I am always optimistic.