Everett Roach
Sr. Director, Product Management
Qualcomm Technologies, Inc.

Advancing charging technologies: Qualcomm®
Quick Charge™

3G/LTE Summit
September 14–16, 2015
Hong Kong
Agenda

• Battery Management Landscape
• Quick Charge 2.0 snapshot
• Quick Charge 3.0
  – What it is
  – Comparison vs Quick Charge 2.0
  – Availability
• Type C connector is coming
• Summary
Battery management landscape

Consumers demand their handset to be charged and ready

- Batteries keep getting bigger >4000mAh
- Handsets getting thinner
- Almost 50% of consumers charge their phone for 30 minutes or less
- Consumers have come to expect fast charging feature
- Innovation needs to keep step with consumer expectations

Mobile industry needs technology and standards that pave the way for getting more power into the handset

*Qualcomm Technologies Research
The evolution of fast charging technology

Qualcomm Technologies, Inc. is a leader in battery management advances

- **AICL | APSD**
  - Identifying actual current rating of USB power sources

- **Quick Charge 1.0**
  - Fastest charging via 5V USB power sources

- **Quick Charge 2.0**
  - Enabling industry’s first mobile true fast charging

- **Quick Charge 3.0 + Intelligent Negotiation for Optimum Voltage (INOV)**
  - Introducing green fast charging technology and enabling intelligent power exchange for charging

- **Battery Saver**
  - Extending battery life during quick charging event

Introducing green fast charging technology and enabling intelligent power exchange for charging

Intelligent Negotiation for Optimum Voltage is a product of Qualcomm Technologies, Inc.
**Challenge: How much power can we put into the battery?**

<table>
<thead>
<tr>
<th></th>
<th>Quick Charge 1.0</th>
<th>Quick Charge 2.0</th>
<th>Quick Charge 3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>2013</td>
<td>2015</td>
<td>2016</td>
</tr>
<tr>
<td>Power</td>
<td>x</td>
<td>1.5x</td>
<td>&gt;2.0x</td>
</tr>
</tbody>
</table>

- **AICL (Automatic Input Current Limit)**
- **APSD (Automatic Power Source Detection)**
- **AICL, APSD**
- **HVDCP**
- **Parallel Charging**
- **AICL, APSD**
- **HVDCP+**
- **Parallel Charging+**
- **INOV**
- **Battery Saver Technologies**

*Based on internal tests charging a 2750mAh fast charge battery (1.5C charge rate) and using the maximum power for a thermal limit of 40C for all charging implementations. Charge time based on 0% to 50% (August 2015).*
Quick Charge 2.0 Milestones

#1

A leading method for fast charging*

• Worldwide standard open for use with any architecture
• Available for 3 years
• Carrier and consumer preference

100+

Accessory products available

• Variety of types: wall and car adapter, battery packs, docking stations
• Available in-box from certain OEMs, plus online, retail and carrier stores

40+

Mobile Devices

• Asus
• Fujitsu
• Google
• HTC
• LeTV
• LG
• Motorola
• Samsung
• Sony
• Xiaomi
• ZTE
• and more

*Qualcomm Technologies Research
Available Quick Charge 2.0 accessories and devices
Quick Charge 2.0 making headlines
Handset makers are using Quick Charge as a product differentiator and key selling point

“Motorola also bigged up the new Moto X Style’s ‘TurboPower’, which makes the Moto X Style the world’s fastest-charging phone.”
Recombo

“LeTV One Pro and One Max, First USB Type-C Smartphones to Support Quick Charge 2.0”
GizmoChina

Quick Charge 2.0 is the underlying technology driving OEM brands such at TurboPower, Rapid Charger, etc.
Quick Charge 3.0 quick facts

100% Faster charging than Quick Charge 1.0

38% Power dissipation reduction vs. Quick Charge 2.0

- 100% Backwards Compatible with Quick Charge 1.0 and 2.0
- Cost similar to Quick Charge 2.0
- Connector agnostic – can be implemented with USB Type-A, USB micro, USB Type-C or proprietary connectors

The first charging technology to employ an intelligent algorithm allowing your portable device to determine what power level to request at any point in time, enabling optimum power transfer while maximizing efficiency.

Based on internal tests charging a 2750mAh fast charge battery (1.5C charge rate) and using the maximum power for a thermal limit of 40C for all charging implementations. Charge time based on 0% to 50% (August 2015).
Quick Charge 3.0 intelligently finds optimum voltage setting for a given device

Quick Charge 3.0 adapter
3.6V to 20V in 200mV steps, 3A (10W-60W)

Compatible

Intelligently moves 3.6V to 20V in 200mV steps, up to 3A (Type C)

Quick Charge 3.0 equipped smartphone
3.6V to 12V Input Device

1. Standard USB cable connected
2. Smartphone detects a Quick Charge 3.0 adapter
3. Smartphone requests a voltage from the adapter
4. Adapter adjusts voltage actual power need
Video: Quick Charge 3.0
Comparing technologies

Quick Charge 2.0

- 4C to 6C cooler
- 16% faster
- 38% more efficient

Quick Charge 3.0

Parallel Charging +
with Quick Charge 3.0

- 7C to 8C cooler
- 27% faster
- 45% more efficient

Parallel Charging
with Quick Charge 2.0

Based on internal tests charging a 2750mAh fast charge battery (1.5C charge rate) and using the maximum power for a thermal limit of 40C for all charging implementations. Charge time based on 0% to 50% (August 2015).
Quick Charge 3.0 will be in the newest Qualcomm Technologies’ chipsets

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**Power Provider Chips (many available now)**

<table>
<thead>
<tr>
<th>Power Provider</th>
<th>Quick Charge 3.0 Interface</th>
<th>Quick Charge 3.0 AC/DC processor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualcomm® WiPower™ wireless charging technology</td>
<td>Power Integrations</td>
<td></td>
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<tr>
<td>On Semiconductor</td>
<td>Dialog Semiconductor</td>
<td></td>
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<tr>
<td>ST Microelectronics</td>
<td>NXP Semiconductor</td>
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<tr>
<td>Etron Technology</td>
<td>Via Labs</td>
<td></td>
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<tr>
<td>Others</td>
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</table>

**QTI Chips/Platforms**

<table>
<thead>
<tr>
<th>QTI Chips/Platforms</th>
<th>Quick Charge 2.0</th>
<th>Quick Charge 3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMB1356/7/8/9</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>SMB1350/51</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Qualcomm® Snapdragon™ 804/808 processor</td>
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<td></td>
</tr>
<tr>
<td>Snapdragon 617</td>
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<td>yes</td>
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<td>Snapdragon 618</td>
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<td>yes</td>
</tr>
<tr>
<td>Snapdragon 820</td>
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USB Type-C
USB Type-C and Quick Charge

Quick Charge provides a small, low-cost mature charging technology for Type-C based portable devices.

USB Type-C connectors enable an improved user experience.

Transition to Type-C is starting at premium tier.

Qualcomm Technologies, Inc. supports Type-C and provides superior implementation as well as continued technology leadership.”
The new USB Type-C connector enables an improved user experience and is embraced and supported by Qualcomm Technologies Inc. and its platforms.

Quick Charge technology is connector agnostic and therefore is already being utilized with Type A, Type micro, Type-C and proprietary connectors.

First Premium Tier phones are already available with Type-C and Quick Charge technology for superior consumer experience (superior connector and superior charging experience).

Quick Charge technology is flexible and is co-existing with many other technologies (examples: WiPower, SlimPort, USB PD, others) to provide superior charging experience.

Quick Charge remains a cost effective, high efficiency and flexible technology for mobile devices and power accessories.

Qualcomm Technologies, Inc. is supporting Type-C and will provide superior implementations as well as continued technology leadership.
Summary

- Up to 75% faster charging* - Under 1 hour in certain implementations
- Quick Charge 3.0 significantly improves efficiency above Quick Charge 2.0
- Connector agnostic. Compatible with USB type A, USB micro, USB Type C and proprietary connectors
- 100% backwards compatible with Quick Charge 1.0 and Quick Charge 2.0
- Established ecosystem with devices and accessories

*Based on internal tests charging a 3300mAh battery using a [1] QC2.0 USB wall adapter (9V, 2A), [2] USB wall adapter (5V, 2A), and [3] USB wall adapter (5V, 1A), respectively. (February 2013)
Thank you

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