ARM mbed objectives

Managing IoT devices

Connectivity
Addressing the complexity of reliably connecting high volumes of diverse devices across different networks

Management
Enabling scalability through interoperability, provisioning and update across the supply chain

Productivity
Framework that allows your organization to fast track ROI from IoT data

Developing IoT devices

Efficiency
OS and Software purpose built to leverage the world-class efficiency and features of ARM Cortex Architecture

Security
Trust through end-to-end security, from on-chip hardware protection to secure connectivity and management

Productivity
Partner ecosystem and developer community driving shared investment in open source components, tools and workflows
ARM Cortex-M Architecture

mbed OS

mbed Device Connector

mbed Cloud Partnership

mbed Silicon Partnership
Collaboration and contributions from over 55 partners

mbed Enabled
Over 100 boards available for developers to get started
2016: The breakthrough year for IoT

- ARM mbed based solutions powered by partnership are transforming key growth markets
- Over 900,000 compiles per month average so far
- Key connectivity technologies helping solve the device diversity challenges
- Powered by a strong, vibrant and growing ecosystem
Smart construction concrete monitoring solution

- Based on mbed Smart City Reference Design using Sub-GHz 6LoWPAN and CoAP mesh networking, mbed OS and mbed Device Connector
- Deployed in field at construction sites by UK’s top concrete manufacture
- Solution reports the maturity of a concrete pour in real-time, eliminating delays manual measurements and can save £50k per annum* on project costs

(*Converge data)
In August 2015, the Cardiology Department of Leiden University Medical Center (LUMC), a leading European hospital, completed a 6-month, 100-patient pilot review of the Zebra Time Tracking Solution based on ARM mbed and the solution has now moved into commercialization phase for all AMI patients.
BBC micro:bit

Programmable IoT device given free to every 12-year-old child in the UK

Enabled by the mbed ecosystem

Shipping in February 2016
Growth Opportunity in IoT

1.6B
Smart Home
60% CAGR

1.8B
Smart City
50% CAGR

1.1B
Other
40% CAGR

Expected number of IoT devices shipped in 2020
Simplifying developing IoT devices
IoT projects need a Platform OS

- Historically, embedded microcontroller design has had little code or design commonality between systems that enables widespread re-use
  
  ![RTOS, Bespoke Middleware integration and Application]

  Development time

- The communication, device management and security demands of IoT devices are a disruptive jump in complexity that drives the need to use a Platform OS
  
  ![Platform OS and Modular Component Middleware, Application]

  Development time
Platform OS Requirements

- Accelerate the development of IoT devices
  - De-fragmenting the software community for constrained devices (MCUs)
  - Bring modern development methodologies to MCUs
  - Provide core, portable OS functionality for MCUs

- Accelerating the deployment of IoT devices
  - Provide standardised connectivity to the cloud
  - Provide manageability from the cloud

- Develop and leverage an ecosystem
  - Freely available
  - Open source
  - In collaboration with partners
mbed OS

- Development Platform and Operating System for ARM Cortex-M MCUs
  - Built-in security
  - Connectivity and Networking
  - Portability for wide choice of Targets and Toolchains for developers

- Tools & Workflow
  - Package management and build system
  - Open collaboration with partners and users
  - Consistent workflow across choice of hardware, development host OS and IDE
  - Extensive resources for developer ease on mbed.com
Enhancing the mbed OS with the partnership

- **RTOS** incorporated in to the core of the mbed OS
  - Enables native support for threading within the OS, based on the latest CMSIS-RTOS RTX
  - Simplifying integration of complex application components, expanding applicability

- **Simplified Tooling** with native support for different toolchains
  - Tested against and user selectable across ARMCC, GCC and IAR
  - Yotta is not used in this release; dependencies are explicitly pinned for full reproducibility

- **Compatibility** with the existing mbed Classic ecosystem
  - For partners, takes advantage of historic investments and aligns future investments
  - For developers, makes all the existing components and libraries available in mbed OS
Widest choice of solutions for deployment

### mbed OS Connectivity
- Bluetooth (BLE)
- WiFi
- 6LoWPAN Sub-GHz Mesh
- NFC
- Thread
- LoRa LPWAN
- RFID
- Ethernet
- Cellular

### mbed OS Security
- mbed Client
  - Lifecycle Security
- mbed TLS
  - Communication Security
- mbed uVisor
  - Device Security
Simplifying the device side complexity
Bridging the diversity of devices: Sensors to Servers
mbed Device Connector: For simplified scaling

- mbed Device Connector eases development, management and scaling of IoT
- Available at connector.mbed.com. Easy transition to commercial service providers
Device Connectivity Fast Track with mbed Device Connector

- Free for development purposes
- 100 devices, 10,000 events per hour
- Caching and subscription aggregation
- Strong end-to-end trust and security
- Based on industry standard protocols for energy-efficient data communication
- REST APIs for easy integration with existing systems
- Full integration with and web tools on mbed.com
mbed Client

- Connects to mbed Device Connector and application cloud of your choice
- Portable to other platforms including Linux and third party RTOS
- Implements protocols and support for securely publishing resources (e.g. sensor data), and managing the devices from cloud
Accelerating through partnerships
mbed OS Platforms
400+ Contributed components
mbed Wearable Reference Design on mbed.com

- Build differentiated products quickly
- Ultra Energy Efficient Products
- Tools for successful ecosystem

Components and code needed to bootstrap

Tested to deliver 8-week long battery life

Ready development tools from mbed partners
WIZnet - IoT Device Platform Company

- WIZnet is a Fabless Semiconductor Company with 20 years of history.
- WIZnet’s **Internet Offload Platform** (Hardwired TCP/IP Technology) offers optimized Internet connectivity for IoT.
Wiznet - Industry leader of Open Source Hardware

- W7500 (Cortex-M0 + WIZnet’s Hardware TCP Offload Engine) is based on Open Hardware Platform
Accelerating IoT through partnerships

Address: Wide choice of hardware, software and examples for IoT

Accelerate: Device scale to cloud choice needs to be simple

Amplify: Partnerships are key to the growth of IoT
Thank you

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