



Technology Brief

OVERCOMING THE LIMITATIONS OF IoT DEVICES AND WIRELESS NETWORKS

Optimizing your IoT deployment with
WindSpring's SpringBoard IoT tools



IoT: The Road Ahead May Have a Few Bumps in It

The Internet of Things (IoT) is exploding as new smart devices, sensors and applications enter the market. But sooner or later, every company working on an IoT project is going to face serious challenges related to data, protocols and networks. These challenges may not be evident at the start, but they are very likely to become an increasing problem as deployments start to scale.

From a data perspective, addressing these issues requires consideration of the physical device itself in terms of the amount of storage and memory available, the size of the messages being sent, any network restrictions on message size, the protocols being used and the costs associated with sending the data over a wireless network.

WindSpring's sole focus is on helping our customers overcome these issues with our proven SpringBoard IoT optimization tools, accelerating development and supporting easy to implement, cost-effective solutions across disparate networks and devices. SpringBoard was designed for device makers, wireless carriers and IoT platform providers to support both embedded and system-on-a-chip (SoC) implementations.

Reinventing Compression to Reduce the High Cost of Data

All IoT deployments depend on wireless networks to transmit device data to the network back-end. But wireless data costs can quickly become a critical obstacle to ensuring the economic viability of an IoT project. These data networks are expensive, and with IoT devices often generating frequent, bursty messages, wireless costs can quickly spiral out of control.

WindSpring is working with customers across a wide range of IoT solutions that use low-cost devices with limited memory, storage and compute power. But some of these devices can generate hundreds

of megabytes of data per day. Add that up in wireless data costs over a 3G network, and any IoT solution will quickly lose its economic footing.

WindSpring has helped these customers integrate SpringBoard Intelligent Compression

SpringBoard IoT Tools: Data Savings by Vertical				
	Smart Meter	Global Tracking Device	Medical Device	Connected Car
Original Message Size	40 bytes	403 bytes	1k	2k
Compressed Message Size	4 bytes	20 bytes	25 bytes	100 bytes
Data savings per message	10x	20x	40x	20x
Total data savings = Per message savings x number of messages per day x 365				

Estimated compression rates in IoT devices using SpringBoard Intelligent Compression APIs

APIs into their solutions. The results? As much as a 20:1 reduction in data, yielding an economical solution that reduces operational expenses and accelerates development.

SpringBoard Intelligent Compression APIs employ an IoT purpose-built, multi-stage approach that compacts, compresses and converts device data, delivering compression rates not seen before in IoT. [See final page for more details]

Winning the Device Battery-life Battle

Whether an IoT deployment is for agriculture, oil and gas, utilities or any other vertical market, IoT devices are being designed to serve a specific purpose, and to operate remotely in the field for years. But the protocols being used may create problems because they add significant overhead, increasing data usage, and limited device memory and storage may require the device to send very frequent messages.

For example, a given device might send a message that's just 100 bytes. But adding in the overhead from the protocol could increase the message to over 300 bytes, a 3x increase over expected data usage. That increase can make the message too big to work within the device or network constraints. Given the low cost of these devices, memory and storage are limited, which can increase the frequency of messages being sent, and adversely affect battery life.

SpringBoard extends device battery life by optimizing both the data and the protocols being used, drastically reducing the frequency and size of device data transmissions.

Taking Advantage of Low-Power Networks

New, low-power wireless networks are now part of the IoT landscape, from category 1 LTE to LoraWAN, Sigfox and a host of others. These narrow-band networks offer lower costs but come with a number of considerations, including traffic restrictions and the potential to add latency to data communications.

While each of these new network technologies should be carefully considered in terms of traffic restrictions, latency, performance and memory usage, SpringBoard IoT tools are designed to work with any network, providing the ultimate in flexibility as they choose the best solution for their deployment.

Sigfox, for example, uses sub-GHz frequency bands and allows up to 140 messages per day, with each message limited to just 12 bytes. Multiply those numbers and you see that a single device is limited to a minuscule 1.6 Kb of data per day.

Bluetooth LE, another emerging LPWAN technology, is focused on increasing IoT device battery life by reducing the size and frequency of device messages for ultra-low power consumption. The problem is, Bluetooth LE severely limits message size. And those limits may mean messages get backed up, introducing an unacceptable level of latency into the IoT solution.

Let's use a device that runs on Bluetooth LE at 100 kbps and sends 2MB of data per message as an example. To work within the 100 kbps constraint, the data will need to be broken down into smaller packets, sent over time. In

fact, that 2MB will need to be broken down into 20 separate messages, taking a full 20 seconds to send. Then add in Bluetooth's inherent 3-6ms latency, plus messages that need to be resent due to errors, and latency becomes a huge problem as the data isn't received fast enough to be useful.

How do you move all the data that an IoT device delivers — clearly one of the primary benefits of IoT itself — from the device to the network back-end, when you can't get it across the network? SpringBoard IoT tools make it possible, radically reducing data payloads so network constraints won't slow your data down.

WindSpring leveraged more than 10 years of expertise in working with low-power, memory-constrained devices and LPWANs to create SpringBoard. Using lessons learned in developing its many patents in compression, WindSpring achieves previously unheard-of compression rates in IoT.

And, while traditional thinking says compression slows things down, SpringBoard runs at 15 GB / second. That exceeds the data and storage speed of just about any IoT network, eliminating latency.

Solving the Protocol Problem

While compression is a key driver in ensuring the success of an IoT deployment, enabling the long and growing list of protocols that are associated with IoT deployments to communicate with each other is its own challenge.

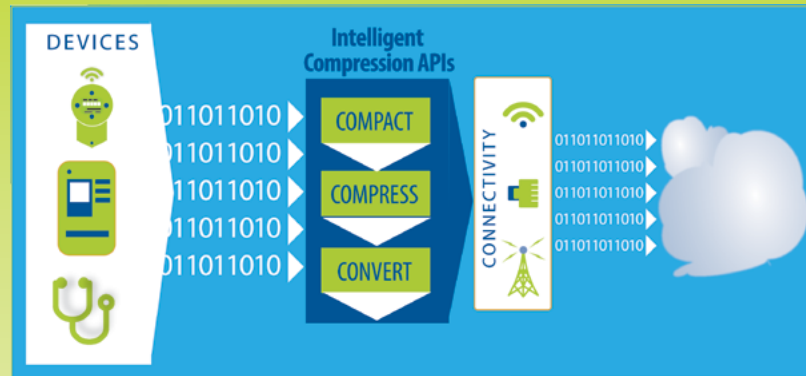
Some deployments may use a network back-end that only talks HTTP, for example, while the IoT device itself may use another protocol. The SpringBoard A2A Protocol Connector solves this problem by enabling any protocol to communicate with any other protocol.

The A2A Protocol Connector also offers optimized protocols that can reduce the amount of data being sent, without disrupting network back-end connectivity requirements, reducing deployment and development costs.

The A2A Protocol Connector resides on the front-end of a server in the cloud or data center, ensuring seamless, two-way, end-to-end communications between any device, over any protocol, to the network back-end. It receives device data in any protocol and translates it on the fly into the required network protocol, then sends it to the server or any client device in real time. [See example on following page]

The A2A Protocol Connector works with dozens of protocols — including HTTP, Apple HomeKit, Nest Weave, Google Brillo, MQTT, AllJoyn, ZeroMQ (0MQ) and CoAP (Constrained Application Protocol) — and is continually updated to work with new protocols as they are deployed. That means you now have a future-proof connectivity solution as you grow your IoT business.

SpringBoard IoT Tools: Multi-Stage Compression Plus Protocol Optimization



SpringBoard Intelligent Compression APIs: 3-stages of optimization

Stage 1: Compact

The example at right shows a typical IoT device message used in a location tracking device. During compaction SpringBoard Intelligent Compression APIs pre-process the data by analyzing it to determine the type of data and which elements can be reduced before sending it on to the compression algorithm for encoding.



Location Tracking Device

```
{ "e": "INFO_LOCATION_UPDATE", "ts": 1439972319788, "bat": 59, "chrg": false, "val": { "lat": 64.9963989258, "long": 25.5061779022, "alt": 21, "spd": 28, "hdg": 70.7162017822, "acc": 18 } }
```

Actual Data: 166 bytes

Stage 2: Compress

The Intelligent API encoder selects the appropriate SpringBoard compression algorithm to achieve optimal compression.

```
POST / HTTP/1.1
Request Method: POST
Request URI: /
Request Version: HTTP/1.1
User-Agent: curl/7.22.0 (x86_64-pc-linux-gnu)
libcurl/7.22.0 OpenSSL/1.0.1 zlib/1.2.3.4 libidn/1.23 librtmp/2.3
Host: xxx.xx.xx.xx
Accept: */*
Content-Length: 166
Content-Type: application/x-www-form-urlencoded

{"e": "INFO_LOCATION_UPDATE", "ts": 1439972319788, "bat": 59, "chrg": false, "val": { "lat": 64.9963989258, "long": 25.5061779022, "alt": 21, "spd": 28, "hdg": 70.7162017822, "acc": 18 } }
```

HTTP Headers + Data (403 bytes)
(237 + 166 bytes))

WindSpring optimized HTTP/Data

(20 bytes (5 + 15 bytes) 20:1 reduction)

Stage 3: Convert

During conversion SpringBoard Intelligent APIs employ one of several optimization options to achieve maximum compression. The API first identifies any restrictions on message size (as in the SigFox example) then identifies which protocol is being used. The software then determines whether there is an optimized or less chatty protocol residing on the device that can be used, then parses the messages accordingly. On the server side, the A2A Protocol Connector employs one of WindSpring's optimized protocols, or a less chatty standard protocol, then hands the data off to the server in whatever protocol is required.

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