



**Actility ThingPark**  
**Appendix B - Technical Features List Product**  
**Functional Description**

**April 2019**

**Under NDA**

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## VERSIONS

<a href="#">Version</a>	<a href="#">Date</a>	<a href="#">Author</a>	<a href="#">Details</a>
01	31/12/15	Shmulik Solomon	First version
02	20/6/16	Shmulik Solomon	Version 3.1 updates Connectivity Manager Updates Removing section 5.10 - ThingPark Wireless & Marketplace and Store Physical Servers, Network Services, Security and Topology Flows Removing section 5.11 - ThingPark Cloud Physical Servers, Network Services, Security and Topology Flows Add details on Subscribers subscription activation processes (License Manager)
03	25/9/16	Shmulik Solomon	Version 3.1.1 updates Version 3.2.x updates Product renaming “ThingPark Cloud” with “ThingPark X” General Updates
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06	27/2/17	Shmulik Solomon	TP OS, TP v4.0.1, Datalogger updates
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11	14/3/18	Shmulik Solomon	Version 5.0.1 updates
12	26/04/19	Ramez Soss	Updates for TPW release 5.2.2

## REFERENCE DOCUMENTS

	<a href="#">Documents</a>	<a href="#">Author</a>
01	ThingPark Product Software Release Notes	Shmulik Solomon
02	Device Address Manager User Guide	Lucile G.

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## ACRONYMS AND DEFINITIONS

Acronyms	Definitions
ABP	Activation By Personalization
ADR	Adaptive Data Rate
AES	Advanced Encryption Standard
AS	Application Server
ATM	Asynchronous Transfer Mode
BPM	Business Process Management
BSS	Billing Support Systems
CRC	Cyclic Redundancy Check
CSP	Communication Service Provider
DC	Duty Cycle
End Device	A sensor or actuator
ESP	Estimated Signal Power
ETSI	European Telecommunications Standards Institute
HAN	Home Area Network
HSM	Hardware Security Module
IaaS	Infrastructure As A Service
IEC	International Electrotechnical Commission
IoT	Internet of Things
ISM	Industrial Scientific Medical
GSCL	Gateway Service Capability Layer
GTM	Go To Market
KPI	Key Performance Indicator
LC	Logical Channel
LoRaWAN™	Long Range Wide Area NW
LPWAN	Low Power Wide Area Network
LRC	Long Range Controller
LRR	Long Range Relay
MAC	Media Access Control
M2M	Machine-2-Machine
MTBF	Mean Time Before Failure
NAT	Network Address Translation
NW	Network
NSCL	Network Service Capability Layer. Also called RMS.

Acronyms	Definitions
OBIX	Open Building Information Exchange
OSS	Operations Support Systems
OTA	Over The Air
PER	Packet Error Rate
PKI	Public Key Infrastructure
POC	Proof Of Concept
REST	Representational State Transfer
RF	Radio Frequency
RIT	Receiver Initiated Transmit
RSSI	Received Signal Strength Indicator
SaaS	Software as a Service
SF	Spreading Factor
SLRC	Secured LRC (VPN Concentrator)
SMP	System Management Platform
SMTP	Simple Mail Transfer Protocol
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SSH	Secure SHell
SSO	Single Sign On
TLS	Transport Layer Security
TWA	ThingPark Wireless Application
UNB	Ultra Narrow Band
VM	Virtual Machine
VPN	Virtual Private Network
WS	Web Service

# 1 SCOPE

This document provides a functional-level description of Actility's ThingPark Product Version 5.2.2.

Note: throughout the document, all references to LoRaWAN™ functionality are based on LoRaWAN™ version 1.0.3.

## 2 THINGPARK SOLUTION OVERVIEW

### 2.1 ThingPark Solution Architecture Description

The ThingPark set consists of four main key components:

- ThingPark Wireless – Core network and OSS
- ThingPark OS
- ThingPark X
- ThingPark Enterprise

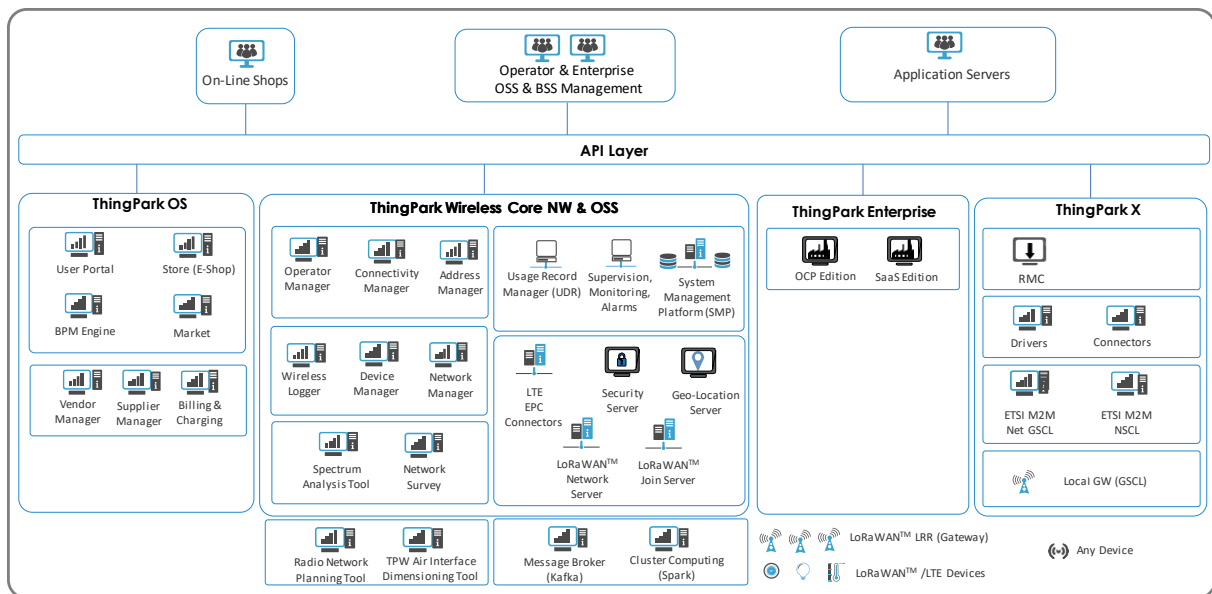
The ThingPark platform is a **modular solution** enabling Network Operators to:

- Deploy LPWANs based on LoRaWAN™ or LTE with **ThingPark Wireless**.
- Manage, activate and monetize IoT bundles (Device, connectivity and application) with **ThingPark OS**.
- Provide value-added data layer services, such as protocol drivers and storage with **ThingPark X**.

**ThingPark OSS** acts as the central System Management Platform (SMP), enabling all other ThingPark platform modules with base capabilities such as subscriber management, centralized authentication and access rights, and workflow management.

**ThingPark Enterprise** is an Internet of Things (IoT) platform that manages private LoRa® Networks. The ThingPark Enterprise edition is used by companies to support their specific business.





**Figure 1 - ThingPark Solution Architecture Description High Level Product Illustration**

*Please note that the modules above may be representing a physical server, a function, a service or a business support layer as part of the overall ThingPark solution and not necessarily a physical HW server*

## 3 THINGPARK APPENDIX B - TECHNICAL FEATURES LIST FUNCTIONAL KEY CAPABILITIES

### 3.1 Introduction

Actility ThingPark bridges Devices, Gateways, Network and Application Servers residing in an IoT network architecture, providing comprehensive functionality that ensures systems have a bi-directional communication channel with each other as effectively as possible. Device data is captured via Gateways, uploaded into the Network Server and then forwarded to the appropriate Application Servers. Application Server data is sent to Devices via downlink messages through the Network Servers and Gateways. Radio streams are optimized and enriched, which translates into better Device and Gateway performance and reduced costs for hardware, software and maintenance while providing new opportunities to differentiate and personalize services.

It also provides an advanced Marketplace and Store commercial functional framework enabling IoT Operators, Providers, Vendors and Developers to sell their offers to Subscribers. And for the later, to profit from an enriched dynamic IoT market offering.

The ThingPark X functionality gives additional dimension to ThingPark functionality, by enabling the support of different M2M Devices, share a given data stream with other applications and Data storage services.

### 3.2 ThingPark Wireless

Feature Category	Feature	Feature Description
LoRaWAN™	LoRaWAN™ Profile Class - A, B, C	Three different classes (A, B, C) of communication profiles are available in LoRaWAN™
	Passive Roaming	The possibility to transfer a packet from one network operator to another in a transparent way while keeping the MAC layer management in hosting network
	LoRaWAN™ MAC versions	LoRaWAN™ 1.0, 1.0.1, 1.0.2, 1.0.3 and 1.1
	LoRaWAN™ Regional Profiles (PHY)	EU 863-870 MHz, EU 433 MHz, US 902-928 MHz, AU 915 - 928 MHz, AS923, KR 920-923 MHz, CN 779-787MHz, CN 470-510 MHz, IN 865-867MHz.
	LoRaWAN™ Backend interfaces	Compliant with version 1.0
	Device attachment	Both ABP and OTAA modes supported
	Duty Cycle	Support radio device and Base Station governmental regulations
Base Station (LRR)	IPSEC VPN	IPSEC tunnelling between LRRs and LRCs, allowing secure managed authentication of LRRs to LRCs
	TLS VPN	Support TLS between LRR and LRC

	LRR VLAN	Provides a higher security level
	IPv4 and IPv6	Both supported
	Real Time Buffering capabilities	Buffering capabilities to prevent packet lost in case of temporary backhaul disconnection
	Support and Maintenance tools	<ul style="list-style-type: none"> <li>■ The LRR proposes a support shell interface with audit, troubleshooting and network configuration capabilities</li> <li>■ Reverse SSH, SFTP, LRR GUI and Watchdog</li> </ul>
	LBT	Support Listen Before Talk mechanism to allow radio transmitters to sense the radio environment before it starts a transmission (mandatory in some Asian countries)
	Downlink transmission status	Provide reliable transmission status of each downlink frame to Application Servers, with associated transmission failure cause (duty cycle issue, LBT, RF modem busy...etc.)
	LoRaWAN packet filtering at base station level	To optimize backhaul resources (especially for cellular/satellite connectivities), the LRR supports filtering of LoRaWAN frames by their NwkID; only authorized frames shall be forwarded to the Network Server.
	Multi-board base stations	Besides mono-board base stations, ThingPark supports multi-board hardware; used for tri-sector configurations and/or extended capacity to support > 16 RF channels.
	Antenna Diversity	Support two receiving antennas to boost diversity. Only relevant for macro gateways following Semtech's V2 reference design.
	Remote RF spectrum scan	RF noise measurements by the base station to assist RF channel planning and optimize radio performance. Measurement results are easily accessible via ThingPark's Spectrum Analysis tool.
	Backhaul redundancy and interface failover	Primary/Secondary backhaul interfaces among the following connectivity options: ethernet, cellular (3G/4G), WiFi, satellite. Automatic switchover to secondary interface once primary interface falls.
<b>Network Server (LRC)</b>	MAC Layer Management	Coordinates messages (frames) and network commands (MAC) between the LRR and the OSS / Applications Servers
	Device traffic master LRC server election protocol	Ensures that uplink frames received by multiple Base Stations will be notified only once to the application servers
	Enhanced ADR Algorithm	Sophisticated and highly optimized Adaptive Data Rate algorithm that considers a joint optimization of TX Power, Spreading Factor and

		number of Transmissions; based on the target uplink quality metrics (Packet Error Rate and overlap criteria)
	Downlink Best LRR selection	In the aim to efficiently transmit a downlink packet, the LRC chooses the best LRR according to its proximity to the device, link budget, duty cycle capacity and connection status.
	RF Region Management	Manage LoRaWAN™ regional parameters + optimization of MAC-layer algorithms
	Application Server Security	Downlink and Uplink security capabilities via Application Server Keys mechanism.
	Optimized transmission of device's MAC commands	Learning algorithm to optimize the retransmission of MAC commands that are either not answered or rejected by the device.
	Device suspension	Provision a Device in a suspend mode
	Tunnel API - Support REST Protocol	<ul style="list-style-type: none"> <li>■ For AS messages exchange</li> <li>■ Advanced queuing mechanism options</li> <li>■ AS authentication Mechanism</li> </ul>
<b>OSS - Network Manager</b>	Network Partner Management	Install, administrate and operate Base Stations
	Downlink Sent Indication	Provide reliable data for billing of downlink frames to avoid situations where downlink messages, which did not reach the destination Device, are not charged by the billing process
	Base Station Alarm Management	Enables the handling of exceptional situations in a Base Station lifecycle
	Statistics and KPIs	Radio statistics, reports and KPIs for Base Stations
<b>OSS - Device Manager</b>	Device Management	Provision, administrate and operate Devices
	Device Alarm Management	Enables the handling of exceptional situations in a Device lifecycle
	Statistics and KPIs	Statistical reports and achievements indicators as for Uplink and Downlink transmissions for Devices
	Authentication, Provisioning and Security	Provision in a securely manner Devices in OTA and ABP modes
<b>OSS - Operator Manager</b>	Operator Manager Backend Interface Manager	The Operator owns and operates an eco-system of Base Stations and Devices
	Dashboard wizard and KPIs	Operator KPIs Web Services and Reports (GUI) based on Apache Kafka and Spark solutions
	Intelligent Framework for project KPIs development	An underlying layer empowering custom KPI development in a project mode

<b>OSS - Connectivity Supplier</b>	Connectivity Manager Backend Interface Manager	Manages technical offers and related Connectivity Plans
<b>OSS - Subscriber Manager</b>	Subscriber Manager Backend Interface Manager	<ul style="list-style-type: none"> <li>■ Provision, Administrative and Operate Devices and Base Stations</li> <li>■ Buy connectivity</li> <li>■ Declare message Routing Profiles and data flow stream towards Application Servers</li> </ul>
	Multitenant Support	Manage and operate a customer with multiple Subscribers
<b>OSS - Vendor Manager</b>	Vendor Manager Backend Interface Manager	Creates and operates a variety of commercial offer bundles
<b>OSS - Supplier Manager</b>	Supplier Manager Backend Interface Manager	Creates and operates a variety of products
	Dedicated Supplier AS	Introduces a unified Application Server for multiple data flow routings
<b>Device Address Management</b>	Device Address Manager Application	Manage the allocation of LoRaWAN™ End-Device addresses (DevAddr) and LoRaWAN™ End-Device EUI (DevEUI) to Suppliers and for B2B/B2C Subscribers
<b>Managed Network</b>	Customer Dedicated Networks	Enable Operators to offer dedicated LoRaWAN™ networks
<b>OSS - API</b>	REST API	Authentication, authorization and usage management for all user's roles
<b>LoRaWAN™ Network Tools</b>	Wireless Logger	Advanced view and analysis Device traffic tool
	Spectrum Analysis	Base Station Radio Frequency scan analysis
	Network Survey	A LoRaWAN™ drive test analysis tool
	Air Interface Dimensioning	Enables a quick assessment of the radio coverage/capacity estimation by providing link budget/capacity analysis
<b>Messaging</b>	Unicast	A single messaging mechanism between a sender (AS) and a receiver (Device)
	Multicast	A multi messaging mechanism between a sender (AS) and receivers (Devices) for LoRaWAN™ Class B and C
<b>Mapping Services</b>	Google Maps	A service allowing to locate Devices and Base Stations on a Google Map
	Open Street Maps	A service allowing to locate Devices and Base Stations on an Open Street Map
	Baidu Maps	Typically used for Chinese markets
<b>Security</b>	HSM - On premises	On site Hardware Security Module
	HSM - SaaS	Cloud based Hardware Security Module
	Secure Element	STM Secure Elements

	Software Security Mode (SSM)	End-to-end data confidentiality (i.e. encrypted payload) between device and AS without physical HSM.
Join Server	Join Sever	A Join Server to enable OTAA Device activation process in a secured manner
	Stand Alone - Advanced Key Manager	Enhanced Key Manager Application to provision OTAA device information and their Application Server keys
Geolocation	TDoA-based geolocation	Location estimation using triangulation algorithms based on the time of arrival and received signal characteristics of uplink frames at the receiving gateways.  Only relevant when fine-timestamps are generated by the base station (need Semtech's v2 reference design) with nanosecond accuracy.
	RSSI-based geolocation	Location estimation is based on the received signal strength level, valid for any base station model (even when GPS/fine timestamp is not available) but has less accuracy than TDoA mode.
	Combined TDoA/RSSI mode	A sophisticated geolocation algorithm supporting a combination of TDoA and RSSI to leverage the strength of both methods and improve the overall location accuracy.
Reliable Multicast	Firmware Update Over the Air	Update Device firmware
	General-purpose multicast	Efficient management of multicast mode by supporting application-layer configuration of the multicast group/session parameters via Actility's RMC-Server.
Supervision, Monitoring and Alerts	Network Devices and Base Stations Supervision	Enables Operators and NW Providers to supervise and monitor their installations
	SNMP Traps	Alert messages in SNMP protocol to an Operator NOC
	Nagios Monitoring	A GUI-powered tool enabling Operators or supervisors to monitor the health of servers, databases and software applications
Platform	Multi Configuration	Platform configuration is available on-premise, SaaS as well as in a hybrid mode
	Active-Active	Disaster Recovery for IaaS implementations
	High Availability	Ensures an agreed level of operational performance
	Scalability	Enables the capacity to be changed in size or scale the platform

	Redundancy	Enables the duplication of critical components and functions of the platform with the intention of increasing its reliability
	Backup and Restore	Framework support to enable data backup and restore
	Non-SQL DB	MongoDB and High Availability (Replication) capabilities
<b>Message Broker</b>	Pre-Integrated with Kafka for UL/DL	Uplink message LRC reporting can be set either via Kafka or HTTP, or both Downlink message transmission over Kafka is a planned roadmap item
	Pre-Integrated with Kafka for TWA Reporting	LRC-OSS reporting interface uses Kafka brokers for enhanced scalability and reliability.

### 3.3 ThingPark Enterprise

Feature Category	Feature	Feature Description
Commercial Model	In a Box Edition	Allows the management of a dedicated LoRa® Network for companies to support specific businesses. Enables on-site fast deployment and reduced upfront costs for customers and System Integrators
	SaaS Edition	Allows the management of a dedicated LoRa® Network for companies to support specific businesses in a SaaS configuration. Provisioned and self-activated through simple commercial processes through Actility Central
<b>Operations</b>	One Click SW Upgrade	The Actility Data Centre is the midway point to process downloads such as catalogues, Base Stations firmware, SW upgrades, and so forth., and perform remote support activities
	One Click LRR SW Upgrade	
	Catalogues / Repositories - simplified upgrade process	
	Simplified Operations	
<b>Platform</b>	Docker Based	Modular platform Docker based to reduce HW fingerprint, ease platform operations such as upgrades and downgrades and all together enables an infrastructure of microservices
<b>DX</b>	DX Bridge - pre-built connectors	Through its Administrator GUI and API, ThingPark Enterprise offers and out-of-the-box activation and management of hosted cloud Applications: <ul style="list-style-type: none"> <li>■ HTTPS Generic</li> </ul>

		<ul style="list-style-type: none"> <li>■ Azure</li> <li>■ Watson Bluemix</li> <li>■ AWS</li> <li>■ and more</li> </ul>
	DX API	Simplified API for Device, Base Stations and Applications Provisioning
	GUI/UX	<p>GUI</p> <p>Developed from scratch on a new Bootstrap Template Genius UI  <a href="https://genesisui.com/bootstrap-admin-template.html?id=genius">https://genesisui.com/bootstrap-admin-template.html?id=genius</a>.          Enables a fast mechanism to build modern administrator sites and dashboard for any browser, tablet or mobile device</p> <p>UX</p> <p>Enables an interaction-rich experience driving users back to the application as well as for those complex functions to become simpler and straight forward to use and function</p>

### 3.4 ThingPark X

Feature Category	Feature	Feature Description
Interoperability and Data Exchange	Multi-source Data	Supports any protocol any data collection - LoRa®, IP, Filesystem and Legacy Protocols (Cocoon)
	(Intelligent) Device Drivers	<ul style="list-style-type: none"> <li>■ Advanced intelligent drivers for most available devices in the market (topology discovery, CoV reporting)</li> <li>■ Device Payload decryption</li> <li>■ Ontology (classifications)</li> </ul>
	Protocol application layer adaptation	<ul style="list-style-type: none"> <li>■ Standard application protocols over LoRa® (ZCL over LoRa®, KNX over LoRa®, etc.)</li> <li>■ Integrate any Application Stack</li> </ul>
Data At Rest	Data Pulling API	Allows third-party integration with data pulling API under access control
	Data Storage	<ul style="list-style-type: none"> <li>■ Big Data store with access control and quota management</li> <li>■ Easy REST API</li> </ul>
	Data Ingestion & Aggregation	<ul style="list-style-type: none"> <li>■ Access and Absorb Data</li> <li>■ Data Streaming / Processing</li> </ul>
	Analytics & BI Reporting	Produces BI reports - a roadmap item
	Data Logging & Visualization	Resource browser, logs and data visualization charts, evaluate patterns and behaviour
	Common Application Infrastructure	IoT Infrastructure shared by authorized applications and secured open data model



<b>Platform</b>	Infrastructure	<ul style="list-style-type: none"> <li>■ SaaS or On-Site configurations</li> <li>■ Scalability, Security, Message Routing</li> </ul>
	Secured Open Data model	<ul style="list-style-type: none"> <li>■ Application access right</li> <li>■ Authentication (x.509 digital certifications)</li> </ul>
	Pre-integrated	Completely pre-integrated with other Activity IoT products TPW and TPOS
	Message Broker	Pre-Integrated with Kafka Message Broker solution
<b>Architecture</b>	Network and Gateway Server Capabilities	Supports the following core capabilities: <ul style="list-style-type: none"> <li>■ Subscribe / Notify</li> <li>■ Device Discovery capabilities</li> <li>■ Message Routing</li> <li>■ Application Servers Authentication</li> </ul>
<b>Applications</b>	Datalogger	<ul style="list-style-type: none"> <li>■ Permits visualizing time series data</li> <li>■ Transparent to device vendors, protocols and device application stacks</li> <li>■ Auto discovers Device capabilities named Data Sources, and enables the application users to map those capabilities into real application graphs</li> </ul>
	ONGBrowser	Graphical user interface tool to interact with the GW and perform various actions on resource entities

### 3.5 ThingPark OS

Feature Category		Feature	Feature Description
User Management		Service Orchestration and Role Management	User Management and User Password Policy Manager
		Multi Role Administrators	Association of Administrator role to different Supplier and Vendor accounts
		User Action Logs	Enables a user action log (audit trail), made for the Operator user, to log all user actions modifying ThingPark application objects
Business Systems	Support	Billing	<ul style="list-style-type: none"> <li>■ CDRs/UDRs - for Post-paid billing managed activation subscriptions</li> <li>■ Managed Customer Network</li> <li>■ Invoice Manager - Invoicing and Payments</li> <li>■ Charging</li> <li>■ Supplier Management</li> <li>■ Offer Management</li> <li>■ Order Management</li> <li>■ BPM - Workflow Management</li> </ul>

		<ul style="list-style-type: none"> <li>■ BSS (Self Activation) via Activity On-Line Store</li> </ul>
Supply Chain Management	Supply Chain Management	Enables Device Suppliers to configure Device keys via a web-service during Device on boarding process
Global Platform Configuration	EMAIL Templates	Support different user notification messages customized by the Operator
	Multi language Applications per Operator	Via labels localization and configuration
	Operator Login Disclaimer	Defines a displayed disclaimer pop-up window after a successful user login in all ThingPark Web Applications
IoT Developer	ThingPark X Subscriber certification	Generation and Deactivation of a X.509 certificate
User Portal	Subscriber Access	After-sale self-care portal, acting as a single gateway to all purchased solutions within the ThingPark Market
	End User Management	Enables the management and creation of End-Users
	ThingPark X Subscriber Management	Enables an interface to manage the Subscriber VGSCS
	ThingPark X Device Widgets	Enables to retrieve Device measured values and manipulate Devices using UI widgets
Marketplace	Shared Suppliers	Shared Suppliers in between different ThingPark Platforms (Operators) via a dedicated Activity SaaS Marketplace
Store	E-Shop Front End	Content System, E-Shop (Presta Shop)

## 4 ABOUT ACTILITY

Actility is an industry leader in LPWAN (Low Power Wide Area) large scale infrastructure with ThingPark™, the new generation standard-based M2M communication platform. Actility's ThingPark Wireless™ network provides long-range coverage for low-power sensors used in SmartCity, SmartBuilding and SmartFactory applications. Actility also provides the ThingPark X which provides big data storage for sensor data and exposes sensor function through an open API allowing developers to provide vertical applications on top of rolled out sensors. To help vendors transform their sensors, Actility provides the ThingPark IoT platform which include embedded software solutions and cloud solutions to help Devices connect to innovative applications. Via the ThingPark Market, an online marketplace engine dedicated to the IoT sensors, applications and network solutions, Actility enables the roll-out of new innovative IoT services for sensor vendors and network solution vendors. Actility is a founding member of the LoRa Alliance™: the largest, most powerful standards-based effort to enable the Internet of Things (IoT). Visit <https://www.actility.com/>.

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