AggreGate®
IoT and Digital Enterprise Platform
About Tibbo

• Founded in 2001
• Offices in Czech Republic, Taiwan and Russia
• Partners network available across 50+ countries
• CAGR: 69% since 2011 (Tibbo Systems)

Members:

• Tibbo Systems (software)
• Tibbo Technology (hardware)
Tibbo Product Portfolio

• AggreGate IoT Integration Platform
• Vertical market products based on AggreGate

• Serial-over-IP converters
• Embedded IoT modules
• Modular IoT gateways: Tibbo Project System
• Programmable controllers and single-board computers
Customers and Partners

- System Integrators
- Engineering Companies
- OEM / ODM Manufacturers
- Managed Service Providers
- Internal Product/Service Development Units of Large Corporations
- Independent Software Vendors / Civil Developers
- Generic Business Customers (derived box product sales)
- Software Distributors / Resellers
- Value-added Resellers
References

- Thousands of installations worldwide
- Many OEM partners deploying white-labeled derivatives
- Customers in all major industries
- Distributed installations for nation-wide companies
- Deep diversification:
  - By market niches
  - By solution types
Some Customers and Partners

- Monitoring of a nuclear-neutron research reactor
- Integrated solution for smart metering and monitoring of IT infrastructure
- Management and monitoring of telco base station power supply units
- Management of industrial uninterruptible power supply units
- Monitoring of Kazakhstan e-government services and IT infrastructure
- Integrated monitoring of a telecommunications operator network

- Narrow-band radio station monitoring system
- Automation of steam turbine operation
- Engineering infrastructure automation in a campus
- Monitoring of payment systems and queues in McDonald’s drive-through
- Monitoring and management of sugar beet storage
- Centralized control of employee attendance in remote offices

- Facility automation of the Electoral Commission Building in Namibia
- Data acquisition from industrial alcohol breath testing devices and monitoring of medical examination stations
- Network and engineering systems monitoring for oil and gas infrastructure facilities
- Integrated automation of data center engineering infrastructure
- A derived out-of-the-box SCADA/MES/OEE product for packaging lines
- Forklift fleet management and monitoring
IoT and Digital Enterprise Platform

Platform Overview
What is AggreGate?

• Software platform or «brick set» for building IoT products
• 15 years of investments into «brick» development
• Vast experience in designing end customer solutions
• Unified environment without acquired / merged products
• More than ten out-of-the-box vertical products
• Thousands of servers deployed for production usage worldwide
• Successful projects across all continents
Who is it for?

System Integrators, MSPs and Engineering Companies:

• Deployment of derived out-of-the-box products
• Vertical market solution deployment
• Cross-industry IoT solution deployment
• Development of replicable reference solutions

IoT Device (OEMs) and Independent Software Vendors (ISVs):

• Own IoT application development
• Short time-to-market and low implementation costs
• Rebranding of white-label platform
• Providing cloud-based IoT services
• Distribution of derived box products
Platform Objectives

- Centralized monitoring, control and configuration for diverse electronic devices and data sources
- Integration with other enterprise systems for exposing device data into them
- Processing, storing and visualizing device data
- Rapid IoT application development and delivery
- Acting as a core of large-scale situation centers
Platform Overview

- Multi-industry device management solution, both B2C and B2B
- Vendor-agnostic device and data source connectivity
- Flexible pricing for OEMs, VARs, system integrators and distributors
- Visual application development process
- Cross-platform and cross-database architecture
- Enterprise integration via open-source SDK and Web Services
- Customization and branding options
- Rapid development of redistributable derived products with
  PoC in 2-4 weeks and first deliveries in 2-3 months
End Customer Business Benefits

- Unique platform architecture based on patented unified data model and metadata enables all platform modules to “speak the same language”
- Seamless integration with actual and legacy IT/OT systems and retrofitted equipment
- 2x to 4x time to market reduction with visual prototyping and vertical application templates for rapid solution design
- Same platform code for all deployments enables unbound logic transfer between On-prem / Cloud / Edge and faster solution design
- Flexible modular architecture and unrestricted platform extension via SDKs and APIs
- Solid foundation for Digital Transformation with Digital Twins, Big Data Analytics and Machine Learning
- Innovative UI Builder for business users / subject matter experts who have no experience in web development
## What’s the Difference?

<table>
<thead>
<tr>
<th><strong>AggreGate Platform</strong></th>
<th><strong>Other IoT Platforms</strong></th>
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<tbody>
<tr>
<td>Focus on private clouds of partners and customers</td>
<td>Mostly abide by SaaS/PaaS delivery model</td>
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<tr>
<td>Successful competition in niche vertical markets</td>
<td>Provide basic modules and APIs only, no CotS products</td>
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<tr>
<td>Full substitution of diverse vertical market products</td>
<td>Don’t replace existing products (SCADA, NMS, etc.)</td>
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<td>Cross-domain feature/module availability</td>
<td>No domain-specific or cross-domain modules available</td>
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<tr>
<td>Focus on large SIs and engineering companies</td>
<td>Mostly oriented to OEM designing IoT devices</td>
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<tr>
<td>Good expertise in large multi-vendor infrastructures</td>
<td>Normally just a few device types in every deployment</td>
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<tr>
<td>SaaS/PaaS + perpetual licensing with one-off payments</td>
<td>Only SaaS/PaaS licensing available</td>
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Partner Business Benefits

• Rapid IoT application design and deployment
• Low-OPEX multi-tenant PaaS/SaaS operation
• Fast integration into enterprise/government
• Easy monetization and billing integration
• Comprehensive rebranding options
• Inexpensive visual product/service development
• Optimization of IT landscape via system unification
• Unlimited scalability to handle future revenue growth
Innovative Technology

- Low-code visual development
- Patented unified data model
- Domain-specific languages
- Failover clustering
- Distributed architecture
- MPP event processing engine
- Secure environment
- Web and HMI-style UI builders
IoT and Digital Enterprise Platform

Full-stack Platform

- **Supervising Layer**: Overall administrative operations and security management
- **Advanced Analytics Layer**: Object and process modeling, machine learning, complex event processing, root cause analysis, etc.
- **Basic Data Processing Layer**: Alerts, scheduled operations, expression and query languages, workflows, etc.
- **Data Aggregation Layer**: Device data caching, synchronization and persistent storage services
- **Direct Operations Layer**: On-the-fly device configuration, control and monitoring operations
- **Device Abstraction Layer**: Edge-side hardware and software agents, cloud-side software device drivers
- **Device Network Layer**: IP networks and physical layer: Ethernet, Wi-Fi, GPRS, LPWA, serial, etc.
Unified Data Model

- Every device and system object have common interface
- This interface describes variables (properties, settings), functions (operations, methods) and events
- Variable values, function input/output and event-specific data items have common format
- All data items may contain scalar values, structures, arrays, tables and can be nested without limits
Modular Architecture

Covering various industries, tasks, workloads, and environments the platform can be deployed as a set of microservices or as a solid application.

- Any kind of functionality (drivers, widgets, reports, etc.) are implemented as plugins.
- All plugins are interacting via a unified data model as a common interface.
- Plugins can be disabled to free CPU and memory resources.
- Partners can develop custom plugins in Java to extend core platform functionality.
Low-code Development

- Extremely rapid workflow and UI development
- Integrated visual UI and report editors builders (including Web)
- Use of expressions and queries is allowed everywhere
- Business rules and data bindings for further assistance
- Scripting is almost never required
- Major projects have been completed with no scripting at all
System Unification

- Manage different systems from a single control center
- Minimize deployment costs and OPEX

Smart Office for Office Building
- Time and Attendance
- Access Control
- Network Management

Smart Home for Residential Building
- Lighting
- HVAC
- Energy Management

Smart Factory for Factory Building
- SCADA
- Forklift Fleet Management
- Remote Monitoring
Open Communications

- Open, SSL/TLS secured, and well documented communication platform-wide protocol
- Intelligent remote access to the unified data model with options to identify objects capabilities, read/write properties, execute operations and get asynchronous notifications
- Allows devices to operate establishing outgoing connections to platform servers only (useful in cellular networks or networks protected by firewalls)
- Optimized for low-bandwidth unreliable device connections
- Ensure unlimited scalability in high-load environments
IoT and Digital Enterprise Platform Connectivity
Connectivity and Data Acquisition

- Any device can talk to the world can be connected to platform in mere days
- Server-side data normalization via **Drivers**
- Device-side data normalization via **Agents**
- **Flexible** driver allows to implement new device protocol support with zero coding
Connectivity via Driver

- Server-side data normalization
- Open-source driver development kit
- More than 50 drivers for standard communication protocols are available
- Support for various IoT, IT, automation and generic protocols
- Driver development professional services
Connectivity via Agent

- Device-side data normalization
- Open-source agent SDK available for Java, .NET, C/C++, Android, Tibbo BASIC
- Mobile platforms supported
- Agents on Tibbo IoT gateways
- Open well-documented protocol
- Firewall / NAT friendly
- Data compression and encryption
Protocols and Drivers

AggreGate supports many IoT, IT, automation and generic protocols:

- BACnet
- CAP
- CoAP
- CORBA
- DLMS/COSEM
- DNP3
- DNS
- FTP
- GPS/GLONASS
- HTTP/HTTPS
- IEC 60870-5-104
- ICMP
- IMAP
- IPMI
- JMX
- KNX
- LDAP
- LON/LonTalk
- Meter-Bus
- Modbus
- MQTT
- NetFlow
- NMEA 0183
- OPC
- OPC UA
- POP3
- Radius
- SIP
- SMB/CIFS
- SMI-S
- SMPP
- SMTP
- SNMP
- SOAP
- SQL
- SSH
- Syslog
- Telnet
- WMI

And even more...
Flexible Driver

- Eliminate Java coding for new device driver development
- Think about command data preparation and reply parsing rather than sockets, buffers, threads, connections, performance, etc.
- Process ASCII and binary streams flowing through TCP, UDP or Serial connections
- Configure support for dynamic and static metadata (device data structure)
IoT and Digital Enterprise Platform

Device Management
Device Management

- Emergency control and debugging tool for administrators and power users
- Real-time monitoring with raw device events
- Ability to check/update device variables and calling functions
- Offline mode support (changes, operations, events are queued until device goes online)

Designed for immediate direct control over connected devices without any custom UIs
In-Platform Data

*Platform stores enormous amount of different data:*

- Configuration of server modules and system resources
- Digital Twins data (models of business objects and relations with actual and historical events)
- Synthetic internal metrics and events
- Unstructured objects (for example pictures, movies or PDF documents)
- Audit trail of all system operations and events

Internally all data divided into 5 major groups: configuration, events, binary blocks, statistics, and topologies.
Data Storage Options

Platform offers wide options range for storage deployment based on data types, hardware resources, target performance and availability:

- **Key-Value database**
  Metadata repository with fast value retrieval and updates

- **NoSQL database**
  High-performance event storage with built-in HA

- **Relational database**
  For classes and other cross-linked data items

- **Round-robin database**
  For time series ultra-fast statistics with constant footprint

- **Graph database**
  For complex topologies

- **File-based storage**
  Lightweight, for embedded devices

*Data Storage compatibility matrix*
IoT and Digital Enterprise Platform

Data Processing and Analytics
Data Processing

- Device Discovery
- Delayed Configuration
- Event Management
- Alerts
- Statistics and Granulation
- Expression Language
- Query Language
- Scheduled Jobs
- Models
- Grouped Operations
- Data Replication
- Scripts
- Workflows
- Complex Event Processing
Event Management

- Normalization
- Real-time monitoring
- Persistent storage
- Pre- and post-filtering
- Masking
- Deduplication
- Acknowledgement

- Enrichment
- External forwarding
- Root cause analysis
- Custom internal routing
- Complex Event Processing and Correlation
Alerting

- Tracking individual resources and resource groups
- Event, state and state change triggers
- Flexible expression-based triggering
- Hysteresis, dynamic baselining, flapping detection
- Notifications via e-mail, SMS, application console popups and sounds, scripts, etc.
- Headless (automatic) and interactive corrective actions
- Customizable escalation rules
Domain-Specific Languages

- **Expression** language is a platform-wide data manipulation language (DML) is similar to Microsoft Excel formulas
- **Queries** module enables platform-wide data query language (DQL) is similar to SQL
- Both languages address unified data model and comply internal security model
- Integrated Java, R and Python scripting for advanced logic scenarios and machine learning cases
- Additional languages supported (such as IEC 61131-3 “softPLC” and others)
Statistical Process Control

**Aggregation of time series data backed by round-robin database**

- Small and constant datamart size
- Ultra-fast access to the any historical data
- Gauge-type and counter-type values
- Configurable precision degradation for older values
- Drill-down option to detailed event history accessible in classic storage
- Powered by embedded Round-Robin Database (RRD)
Granulation

Advanced aggregation of time series data with flexible calculations and timeline slicing

- Unleashed flexibility with custom in-platform aggregation functions
- Any data type of calculated results supported: numeric, text, binary, structure
- Time periods also are custom and can be unevenly spaced
Object and Process Modeling

Models are used to design digital twins of assets, services and processes

- Model comprises:
  - variables, functions, events
  - business rules for decision making
  - data bindings for reacting to events and state changes

- Standalone, attachable and instantiable models available

- Example use cases:
  - Trivial CPU load calculator
  - Pump station
  - Industrial process
Groups and Batch Operations

Groups are mainly used to simplify batch operations with large number of devices and system resources

- Groups can be dynamic with validity expression property used to check whether system resource is valid for this group
- Master values can be defined for members’ common properties to replicate within the group for all other members at the change
Workflows

*Designed for data orchestration and conduction of enterprise business processes*

- Combine server-side logic and operator interaction
- Zero coding drag-and-drop style development with integrated interactive debugger
- Concurrency and event-driven behavior supported
- Lightweight engine can be deployed on Edge tier
Complex Event Processing

Event Correlator plugin with Complex Event Processing functionality

- Full and incremental aggregation over time, length, and session windows
- Detect event occurrence patterns and trends over the time
- Data correlations to detect event anomalies and missing events
- Real-time predictions with online and pre-trained ML models with PMML support
- Connectivity to Kafka, NATS and JMS/MQ
- Power of CEP on Edge tier
Unified Search

- Instant access to any piece of data stored in unified model using search window or programmatically in the app
- **Fast**: any search completes in seconds
- **Flexible**: individual resources or entity types can be added or excluded to/from search index
Classes

*Designed to build applications operating with complex cross-linked objects other than events*

- Typical use-cases are CRM, EAM, MES, ERP, DCIM or Service Desk solutions
- Dashboards are fully aware of Classes to allow view/update individual instances and navigate through a Class-based product
- One-to-one, one-to-many and many-to-many relations supported
- Classes module uses graph or relational database at data storage backend
Machine Learning

Applicable for value prediction, anomaly detection and data classification

- Dozens of built-in algorithms: linear / logistic regressions, decision trees, neural networks, SVM, naive Bayes classifier, and more
- Hundreds of hyper-parameters configurable via the visual UI
- Fully integrated with workflow module enables user friendly stream-based pre-processing, training, scoring and production operations
- In-platform Python / R scripting module enhances data preparation and feature engineering operations
Data Visualization

- Widgets
- Dashboards
- Data Grids
- Video Streams
- Reports
- Configurable Navigation
- Multi-level Drill-down
- Pixel-perfect Customization

**Widgets are used as:**

- Data Entry Forms
- Charts / Trends / Diagrams
- Human-Machine Interfaces (HMIs)
- Floor / Facility Plans
- Topology Graphs / Maps
- Geographical Maps etc.
Widgets
Dashboards

• Drag-and-drop based dashboard editing and customization
• Fully dynamic contents allow 24x7 operator use
• Displaying tables, maps, widgets, events logs, diagrams, video, HMI, etc.
• Incorporation of third-party web UI elements
• Custom navigation from top-level to device / model / process dashboards
• Support for high-resolution displays and video walls
• Publication of dashboards on third-party web portals
Dashboards
Dashboards
Geo Mapping

- Any tiled map sources (Google, Bing, OSM, Yandex, 2GIS, etc.)
- Offline maps support
- Multiple configurable map layers
- Visualization of devices, paths, geofences, links and custom objects
- Map-based topology visualization
- Interaction between Map component and other widget components
- Dynamic map updating upon widget / server events
Video Monitoring

• Custom component for real-time or history video streams playback with optional PTZ (pan-tilt-zoom) control

• Flexible drill-down from geo-maps / floor plans and event logs to video walls

• Dozens of video formats / codecs supported via FFmpeg library

• VMS platform can be controlled externally with events and alerts – directly or on schedule

• Flexible integration with any external video surveillance and analytics platform
Charting and Trending

• Customizable colors, strokes, renderers (line, spline, step, bar, etc.), headers, legends, tooltips, gridlines, crosshairs, range / domain markers, value marks, annotations, and more

• Number of data series and axes can be combined on single chart

• Configurable time units and ranges for time-based charts

• Combined charts allowing several charts to share a single axis

• Thousands of fine-tuning options

• Real-time mouse zooming, panning, and guideline creation

• Context menu for fine-tuning, printing and exporting
Chart / Diagram Examples
Reporting

Printable or file-based tabular data presentation

- Wide range types of data sources: queries, scripts, event / value history, etc.
- In-memory self-service data preparation pipeline by in-platform DML tool Expression
- Embedded report template designer and generator tools
- Integrated report viewer
- Export options are: PDF, RTF, ODT, HTML, XML, XLS, CSV, etc.
- Scheduled reports available via document export and e-mail distribution
Topologies

Graph component visualizes topologies defined in unified data model or underlying relational/graph database

- Generally used to represent IP network connections, electrical wiring diagrams, gas/oil pipeline structures or similar graph-style structures
- Trivial and force-directed layouts like Fruchterman — Reingold or Kamada — Kawai
- Reactions to external events and generation of own events such as “edge click”, “node hover”, etc.
- Visual styles for nodes, edges and labels are fully customized
- Flexible graph navigation
Web UI Builder

*Low-code UI construction tool for business users who have zero experience in web application development*

- Design of modern HTML5 interfaces based on modular CSS grids
- Dozens of built-in React components with easy third-party component integration
- Flexible component configuration and component library management
- Adaptive / responsive layouts support for desktops, tablets, and smartphones
- Comfortable design process for comprehensive nested UIs
IoT and Digital Enterprise Platform Development and Integration
Development and Integration

Application Development

• Java
• Python
• R

External Integration

• Open SDK and APIs
• Java, .NET, C/C++ and Mobile APIs
• SOAP and HTTP/ REST web services
• Data Export and Import (XML, CSV, XLS and more)

Examples of north- and southbound integrations:

• Asset Management
• Helpdesk / ITSM / CMMS
• CRM
• OSS/ BSS
• ERP
• Payroll
• HR Management
• Video Surveillance
Software Development Kit

Unrestricted programmatic extension via:

- Driver Development Kit
- Agent Development Kit
- Plugin SDK
- Server API
- Visual Component SDK
- Samples of plugins, drivers and agents
Portal Integration

Platform integration with Enterprise Information Portals can be performed at data and UI layers:

- **At UI layer:** selected widgets and dashboards get incorporated into 3rd party portal pages
- **At Data layer:** external UI-level app access unified data model using Java / .NET / REST API and via supported device driver protocol
Security and Permissions

• Every individual or program accessing any platform resource need to be authenticated and authorized against permissions

• All communications between servers, clients and agents are SSL/TLS secured by default

• Device drivers support most of security and encryption options provided by protocols

• Users have no direct access to the underlying data stores, all data access requests get through the core like any other operations

• Platform ensure audit trails for all important security issues with logging to files or events
Role-Based Access Control

- Personal and role-based user accounts with mask-based or group-based permissions
- Authorization option over role permissions offers maximal flexibility and multi-tenancy
- External authentication over LDAP / Active Directory or other security services enabled with pluggable authentication modules
- Per-user or shared access control lists
- Fine-grained permission control for any resource
- Active system objects (such as models or alerts) inherits permissions or owners
IoT and Digital Enterprise Platform

Performance, Scalability and Availability
Performance

High performance enterprise digital platform supporting SMP, MPP and distributed deployment options:

- Hundred thousand devices per node
- Up to 5 million metrics or event types per node
- Ten billion daily events / value updates per node
- 100-500 thousand stored events per second per node
- Unlimited scalability with multi-tier distributed deployment

5-10% of these events get passed through the whole event processing workflow and routed to the operator workstations or external systems.

Persistently storing up to:
- 2,000 events per second in a relational database
- 100,000 events per second in a NoSQL database
- Events per second in a distributed installation

Processing up to 1,000,000 events per second.
High Availability

• Own IoT-aware failover clustering technology for AggreGate servers
• N-node active-passive configurations supported
• N-node active-active configurations supported for selected use cases
• Storage-level failover clustering depends on database type
• Fully leveraging HA technology of NoSQL database (Apache Cassandra)
• Integrated relational database fault tolerance module
• No dependencies on custom hardware or operating system
AggreGate Server Cluster + Storage Engine Cluster

Native Database Clustering

AggreGate's Database Clustering
IoT and Digital Enterprise Platform

Deployment and DevOps
Deployment Options

**Cloud (PaaS)**
- Fully virtualized with vertical and horizontal scalability options

**On-Premises**
- Deployable in customer DC on bare metal servers or virtual environment

**Hybrid**
- Balanced for compliance and performance over private and public cloud environments

**Edge**
- Fully featured edge device installation with the same codebase
Marketplace and DevOps

- **Application** module enables packaging code and configuration for transfers between developer workstations and development, test, RC and production servers via Git, Subversion, or plain files.

- **Store** module installable on-premise enables flexible app distribution throughout your SaaS/PaaS infrastructure.

- **Tibbo Marketplace** is the publicly available online application store with vertical solutions and modules developed by ISV/OEM and MSP partners on the top of AggreGate platform.
Edge Computing and Gateways
IoT Edge / Fog Computing

**Business Needs**

- Edge-side data filtering / aggregation to reduce data traffic and latency
- Streaming data analytics
- Device and data security: man-in-the-middle defense; device authorization
- Costs cutting by Data Center / Cloud tiers elimination (for custom cases)

**Actual Obstacles**

- Lot of coding is required even for simple Edge analytics
- Very few low-code development tools on the market
- Software running on the edge and in the Cloud has totally different architecture
- Data processing logic cannot easily migrate between Edge and Cloud
Redefining Edge Computing

AggreGate redefines the Edge Computing paradigm by allowing to run the same IoT app on-Premises, on Edge and in the Cloud

- **Common platform codebase**: no efforts needed for re-design, re-development, re-testing and UAT while moving your app to the Edge
- **Modularity** allows to operate on low-cost hardware like Raspberry Pi, just disable unused plugins to fit into limited hardware resources
- Advanced control, easy upgrade and change management ensured by platform’s **distributed architecture**
- Ideal to monitor, supervise and evolve a large number of remote facilities
AggreGate Edge Advantages

- Wide connectivity options (industrial / consumer)
- Northbound and southbound connections are SSL/TLS secured
- Widest hardware platform support
- Web-based UI for common/consumer users
- HMI-style user interface for industrial touch panels
- High performance CEP / Stream Analytics engine
- Visual application development
- In-platform Machine Learning capabilities
- Seamless integration with other AggreGate tiers
- Full-stack APIs and SDKs (REST, Java, .Net, and more)
- OEM customization and branding options
Modular IoT Gateway Appliance

Tibbo Project System runs fully-fledged embedded AggreGate Server

Primary use-cases:
- Smart Home
- Building Automation
- Industrial Automation
- CNC Monitoring
- Telco Tower Monitoring
- Smart Metering
- Battery Monitoring
- Mobile Asset Tracking
- Physical Security
Tibbo Project System

Tibbit module types:

- GPIO
- ADC/DAC
- Relays
- Power sources
- Serial ports
- GPRS modem
- Wi-Fi module
- Sensors
- LEDs (various colors)
- Buttons
- IR code processor
- Wiegand + clock/data
- PoE
- 3-axis accelerometer
- PIC coprocessor
- Potentiometers
- RTC + NVRAM
- SD card slot
- And more
Tibbo Project System Internals

50+ functional and connectivity modules (aka “Tibbits”) allow to build your own device

Key Features:
• 1GHz Cortex-A8 Sitara CPU
• 512MB DDR3 SDRAM + 512MB NAND flash
• 4 UARTs and 2 CAN controllers on-board
• 10/100 Base-T Ethernet port RJ45 jack
• Onboard RTC with a backup supercapacitor
• 5V power (12V/24V/48V/POE via Tibbit modules)

Linux-based Tibbo Project System (LTPS) board. Supports the Ethernet and optional Wi-Fi and GPRS connectivity
IoT and Digital Enterprise Platform

Distributed Architecture
Distributed Architecture

• Unlimited scalability for digital enterprises of any size

• Peer-to-peer secure connections to share data between servers

• User-defined relations between providers and consumers fit any objective

• Multi-tier vertical server hierarchies (e.g. Smart City)

• Multi-node horizontal scalability clusters (e.g. high-performance event processing)

• Multi-tier distributed installations (e.g. monitoring of a corporate network)
Large-Scale IoT Cloud Platform

LEVEL 1

IP LOAD BALANCER

LEVEL 2
User / Device Directory Servers

LEVEL 3
Data Storage and Processing Servers

CLOUD CONTROL SYSTEM

Manage
Deploy

Templating Server
Database Cluster
Multi-tier IoT Infrastructure
Smart City Management

TIER 5
City HQ Servers

TIER 4
Urban District HQ Servers

TIER 3
Intelligent Building Servers

TIER 2
Direct Management Servers

TIER 1
Devices and Gateways
Multi-segment Network Management

- Multi-tier monitoring and management for large segmented networks
- Unparalleled flexibility for event collection, event consolidation, reporting, alerting and failover clustering on primary nodes
- Built-in low-bandwidth unreliable communications support for geo-distributed deployments
- SSL/TLS secured on internal and external communications
High-Performance Event Management

Distributed architecture ensures unlimited scalability for handling massive event streams:

- **Local processing** servers collect, pre-filter, deduplicate, correlate, enrich and store events

- **Aggregation** servers enable system-wide correlation, alerting and reporting, as well as searching for events throughout the whole united data model
Digital Enterprise

• Leaf servers of united platform can be used for different roles: SCADA/HMI, building automation, remote monitoring & service, physical security

• Organically compatible with embedded AggreGate Edge

• Higher-level / top node provide unified situation center or high-level BI functionality
Horizontal Cluster

- Unified IoT service/application platform for telecom operators and MSPs
- Multi-tenant scenario with tenant and application area demarcation
- Scalability to billions of devices and millions of tenants
- External tenant and user registries
- Fully customizable billing and monetization
Vertical Market Solutions Overview

- IoT Analytics (Cloud and Edge)
- IT Infrastructure Management
- SCADA/HMI and MES
- Data Center Management
- Building Automation
- Fleet Management
- Smart Metering
- Sensor Networks
- Physical Security
- Attendance and Access Control
- Digital Enterprise Platform
- Remote Monitoring and Service
- Incident and Situation Management
- Business Intelligence
- Data Orchestration
- Enterprise Data Bus
IoT and Digital Enterprise Platform

AggreGate Network Manager

- 2 in 1: Out-of-the-box NMS + IT Management Platform
- Umbrella IT Infrastructure and Service Management
- Monitoring of routers, switches, servers, applications, storage, performance, etc.
- Network inventory, CMDB, service modeling and KPI/SLA tracking
- Support for monitoring and management via SNMP, WMI, ICMP, IMPI, JMX, SIP, SMI-S, SMPP, raw TCP/UDP, DNS, POP3, IMAP, SMTP, FTP, SSH, DHCP, LDAP, Radius, CWMP, HTTP/HTTPS, and more
- Network topology discovery/mapping, event correlation and CEP/RCA
- Product works as an extension pack for AggreGate Platform core
AggreGate SCADA/HMI

- 4th generation SCADA: cloud-friendly, web-based, secure, and cross-platform
- Interoperable via standard protocols, leveraging power of NoSQL databases
- Digital twin development framework (object/process modeling, Edge-aware)
- Live remote HMI editing, SVG-based SCADA symbol library included
- High scalability and performance (up 10M tags, 100K tags/sec storage)
- Support for BACnet, DNP3, Ethernet IP, IEC 60870-5-104, Modbus, OPC, OPC UA, SNMP, proprietary protocols (such as Omron FINS), and more
- Alerting, reporting, charting/trending, scripting, SPC, IEC 6113103 “Soft-PLC”
AggreGate Building Automation

• Umbrella BMS for lighting, power, HVAC, metering, water/wastewater, physical security, IT infrastructure, fire safety, elevators, parking lots, and more

• Web-based HMIs on Edge devices (Linux PLCs, touch panels, industrial PCs..)

• Successful track record in Smart City situation center scenarios

• Deep data mining and machine learning tools for improving energy efficiency

• Open-source SDKs and standard protocol support (Modbus, OPC, BACnet, KNX..)

• Alerting, reporting, charting, scripting, querying and other common instruments

• Flexible security model for multi-tier and multi-tenant installations
AggreGate Data Center Supervisor

• The only 4 in 1 solution: IT + Automation + Physical Security + Incidents
• Industrial equipment connectivity for commercial and corporate datacenters
• Monitoring for environment, HVAC/CRAC, UPS/PDU, gensets and more
• Performance analysis, capacity planning and overall facility management
• Access control and video monitoring
• Network core and virtualized infrastructure monitoring
• Control room HMI builder and executive dashboard designer
• Product is delivered as a set of AggreGate Platform modules
Licensing Structure

- Per-server perpetual and PaaS/SaaS licenses available
- Module-based pricing for most solutions and products
- Industrial automation solutions use tag-based pricing
- Event-based pricing for «pure-IoT» products
- Significant volume discounting for distributed installations
- Platform and vertical product licenses are combined
- Failover server license costs 50% of base license fee
- OEM licensing program for hardware manufacturers*

*Ask your Tibbo Systems representative for details
License Types

AggreGate uses software licenses distributed as files via license servers:

- Demo Licenses for Partners
- Trial Licenses (with extension)
- Free Limited Licenses
- Development Licenses
- Commercial Licenses
- Corporate Licenses
IoT and Digital Enterprise Platform

Partner Program
Launching Partnership

- Simple partner authorization procedure
- No contract is necessary for initial sales
- Distribution contract can be signed at any point
- Significant partner discount level
- Partner Deal Registration system
- Lead forwarding from the early stages of cooperation
Partner Program

Three tiers:

- **High support, basic margin level**
- **Medium support, minimal turnover requirement**
- **Highest margin level, joint market development fund**

_Tiers are determined by commitment level:_

- By sales volume
- By level of training/certification
- By ability to support customers
Authorized Partners

Benefits:

• Free web-based support and fixed hourly paid Professional Services
• Partner locator on Tibbo website
• Access to white papers, case studies, presentations and other marketing/sales materials
• Access to leads
• 30% license discounts
• 1 free demo server license

Requirements:

• Tibbo logo or AggreGate web link/information on the website
• 1 Technical and 1 Development training/year (optional)
• 1 Sales training/year (free)
Pre-sales Assistance

- Free design consultations
- Analysis of customers’ RFPs and filled questionnaires
- Tibbo employees can conduct presentations to end customers by acting as Partner’s employees
- Live demo and pilot project preparation assistance
- Technical/marketing training at Partners’ facility (+ travel & lodging is compensated)
- Joint marketing roadmap discussions
Services Overview

- Annual Maintenance and Support (20% of license price, starting from 2\textsuperscript{nd} year)
- Professional Services (fixed hourly rate)
- Upgrades (free while support contract is in force)
- Site visits (fixed hourly rate + travel & lodging)
- Training (fixed price + travel and lodging)
- Turnkey project cost evaluation assistance
Technical Support

- Tibbo can act as 1st and 2nd line support while necessary
- We always remain 3rd line support
- Both Service Desk and online community available
- Remote configuration of evaluation/pilot installations
- Same week critical bugfix releases (usually within 1 day)
- On-demand releases of Early Access Program versions with new features
- Remote troubleshooting of customer’s installations (Skype + TeamViewer)
Professional Services

- Solution design consulting
- Driver/plugin development
- Custom development
- Branding and customization
- Training and education
- Cloud hosting (SaaS)
- Turnkey deployment
- Guided deployment
- OEM project management
- Technical support (email, phone, community, etc.)
- Guided administration
- System configuration
- Remote upgrades
- Performance auditing
- Security auditing
- Elimination of accidents
- Migrations
Turnkey Deployment

• **Option 1**
  Partner acts as a reseller by subcontracting Tibbo for project management

• **Option 2**
  Partner subcontracts Tibbo for individual tasks only (custom development, complex configuration, etc.)

• **Option 3**
  Tibbo is selling licenses only, the deployment is fully covered by the Partner (System Integrator role)
Lead Generation and Management

**Lead Generation:**
- Online marketing, SEO and SMM
- Product webinars and presentations
- Joint press releases and success stories
- Magazines and printed ads
- Trade shows, expos
- Other local events
- Road shows

**Lead Management:**
- Assessing prospects priority
- Online personal demos
- Evaluation follow-ups
- Pilot projects
- On-site visits
- Assistance with building preliminary and target spec
- Pricing proposal and project budget assertion
Partner Evaluation Process

- Business and marketing plans
- Financial objectives
- Translation of AggreGate marketing materials
- Publication of product information on the corporate website
- Online marketing efforts and AdWords campaigns
- Lead follow-up reporting
- Reporting on PR activities and market response
Partner Kit

- Price list
- Questionnaires
- Example RFPs
- Distributor authorization letter
- Reference list
- Technical training plan
- Detailed price offer template
- Product datasheets

- Partner program
- Product white papers
- Comparisons with competitors
- Customer satisfaction certificates
- Case studies
- Documentation (online/offline)
- Product presentations
## Prospect Classification

<table>
<thead>
<tr>
<th>Prospect Type</th>
<th>Primary Business Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Integrator</td>
<td>• Solution Sales (to enterprise customers)</td>
</tr>
<tr>
<td></td>
<td>• Product Development (rebranded or not)</td>
</tr>
<tr>
<td></td>
<td>• Service Development (rebranded)</td>
</tr>
<tr>
<td>Engineering Company</td>
<td>• Solution Sales (to enterprise customers)</td>
</tr>
<tr>
<td></td>
<td>• Product Development (rebranded or not, most products include third-party hardware)</td>
</tr>
<tr>
<td>Enterprise / Corporation</td>
<td>• Solution Sales (via our partners or directly if deployed by own insourcing team)</td>
</tr>
<tr>
<td>Telecom Operator / Managed Service</td>
<td>• Service Development (rebranded)</td>
</tr>
<tr>
<td>Provider (MSP)</td>
<td>• Solution Sales (just like to any other enterprise customer)</td>
</tr>
<tr>
<td>Small or Medium Business (SMB)</td>
<td>• Box Product Sales</td>
</tr>
<tr>
<td></td>
<td>• SaaS Sales (via AggreGate Cloud)</td>
</tr>
<tr>
<td>Hardware Manufacturer (OEM/ODM)</td>
<td>• Product Development (rebranded)</td>
</tr>
<tr>
<td></td>
<td>• Service Development (rebranded)</td>
</tr>
<tr>
<td>IoT Edge Gateway Manufacturer</td>
<td>• Product Development (based on AggreGate Edge, rebranded or not)</td>
</tr>
<tr>
<td></td>
<td>• Solution Sales (via our or manufacturer’s partner network, rebranded or not)</td>
</tr>
<tr>
<td>Independent Software Vendor (ISV)</td>
<td>• Product Development (rebranded or not)</td>
</tr>
<tr>
<td></td>
<td>• Service Development (in third-party cloud, rebranded)</td>
</tr>
<tr>
<td>Referral / Marketing Agent</td>
<td>• Solution Sales (direct contracts between Tibbo and end customers)</td>
</tr>
<tr>
<td>Government</td>
<td>• Solution Sales (via other partners or insourcing teams)</td>
</tr>
<tr>
<td></td>
<td>• Product Marketing</td>
</tr>
</tbody>
</table>
Training and Education

- Our mission is making our partners independent from the vendor
- We target delivering high-quality partner education
- Several on-site training programs are available for engineers, developers, etc.
- Education starts with 5-days AggreGate Basic Technical Training
- Everyone who passed the training successfully becomes an AggreGate Certified professional
- We highly recommend training in partner’s lab in order to connect specific devices during the training and kick-start partner’s first project