Ayla Networks

Ayla Architecture

Focusing on the 'Things' and Their Manufacturers

The Ayla Internet of Things Platform:
Focusing on the 'Things' and Their Manufacturers

The promise of the Internet of Things is usually presented as benefits to end consumers. Safety and security devices that can send an alert to the user when smoke is detected in the home or a door is opened when nobody is home. HVAC and water heating systems that adjust to residents' individual comfort levels. Lighting that automatically illuminates where and when needed for optimal visibility, ambience or safety.

But this consumer-focused view skips a crucial step: Manufacturers of traditional products such as refrigerators and water heaters and lights first need to design and manufacture connected versions of their products. In other words, they need to create the 'things' of the Internet of Things (IoT).

IoT Connectivity Takes Expertise Plus Experience

The step from unconnected to connected products is a daunting one. Unlike the computers and smartphones and tablets we use to connect to the Internet of Computers, the devices of the IoT were rarely designed with connectivity in mind.

Turning traditional products into connected products requires specialized, deep knowledge and expertise in networking, software development, cloud computing and other technologies. In addition, it turns out that the expertise to build connected devices comes only from experience actually building connected devices.

The Ayla IoT platform was born from deep expertise gained by hard-won experience. The essence of the Ayla platform architecture cannot be captured by a single feature or technology. Instead, it can best be understood as a series of decisions and design choices that interact and coalesce into a singular solution that enables manufacturers of all kinds to get to market, quickly and easily, with connected versions of their products.

Then, once their connected products enter the world, manufacturers can use the data generated by their products to enhance the products themselves, forge deeper ties with their end-user customers, improve warranty and maintenance processes, and generate new revenue streams.

Let's look at each of these characteristics in a bit more detail.

It works with any device or product.

From the outset, Ayla has taken the 'things' part of the IoT very seriously.

Fragmentation is a fact of life for the IoT. Each category of product connected to the IoT has its own domain, which likely has nothing to do with the technologies, ecosystems or expertise required for IoT connectivity. The devices now being connected have different processing capabilities, they use different protocols, they comply with different standards, and they have radically different needs and goals from connectivity.

Ayla designed its IoT platform to be generic, meaning it is able to work with essentially any kind of product. For Ayla, it is important that its platform supports an air conditioner just as easily as a thermostat, a medical device, a coffee maker or an oil rig.

Manufacturers are experts in their domains, but rarely are they also experts in making IoT connected versions of their products. The Ayla architecture is built to take care of the IoT connectivity portion of the equation for manufacturers, no matter what kinds of products they make.

Any Data-Set or Service

Any Device   **Any Application**

It encompasses device, cloud and mobile app software.

The Ayla IoT platform architecture takes an end-to-end approach, offering software that spans all the elements of the IoT itself: device, cloud and mobile app.

Here are some of the most important goals and characteristics that define the Ayla IoT platform:

• It works with any device or product.

• It encompasses device, cloud an mobile app software.

• It aims for optimal flexibility, business agility and customer choice.

• It lets manufacturers get to market with connected products—without having to write any code or learn any of the technologies required for connectivity or participation in the IoT.

• It scales: in kind, in volume, in performance and reliability, over distance, over time.

• It transcends arguments about where intelligence should reside in the IoT.

• It provides manufacturers with inherent incentives to create connected devices.

• It plays well with others, and it keeps the future in mind.

Security capabilities that the Ayla platform makes available as part of its platform include:

- Authentication/Authorization/ Accounting (AAA) at both the user and the device level

- Role-based access control (RBAC), including the ability to define multiple roles, to limit who, when and what can reach the Ayla server

- Token-based authentication, which stores personalized information (e.g., username, password) in the end user's service—making available a secured token, rather than the personal information itself, to authenticate the user whenever he or she wants to access a piece of data

- Encryption of data in transit (HTTPS, AES-128 bit encryption) and data at rest (encryption keys, backups)

- Customer-configurable temporal encryption keys

- Passwords that use salted hashing

- SSL tunneling for solid device security out of the box

- Deployment over AWS, which is ISO 27001 certified

- Security groups

- Virtual private cloud deployment over private subnets

Across this full spectrum, Ayla handles security, performance, latency and communications handoffs everywhere. It also takes care of keeping the software, firmware and security of connected products updated and current.

Security is one of manufacturers' biggest concerns when contemplating or implementing connected versions of their products. Ayla believes strongly that in the IoT, security must be handled comprehensively at all levels, including the handoffs among devices, clouds and apps.

It aims for optimal flexibility, business agility and customer choice. Ayla does not take a one-size-fits-all approach to IoT connectivity architecturally, the Ayla platform is a service-oriented architecture (SOA) implementation engineered with the cloud—and the flexibility, business agility and customer choice the cloud makes possible—in mind.

Service Oriented Architecture

SOA, defined as a technique involving the interaction between loosely coupled services, enables a divide-and-conquer approach to

whatever functionality is needed. Each function gets a separate service, and each service is architected to run independently of the other services.

Ayla offers a particularly comprehensive SOA implementation that includes:
- **Device services, such as templates, notification, time and location, image service, and over-the-air updates**

- **User services, including security (Authentication/ Authorization/Accounting, role-based access control, etc.), triggers and alerts, OEM dashboard, and developer website**

- **Application services, such as a rules engine, third-party integrations, and custom rules**

- **Data and analytics services, such as logging and metrics, statistics, reports and data discovery, and ETL (extract/transform/load data)**

Application programming interfaces (APIs) provide the common language among the services in Ayla's SOA-based architecture, allowing the Ayla cloud to communicate easily with the APIs of various other secure clouds and services.

The Ayla platform is communication protocol agnostic, allowing manufacturers to take advantage of Wi-Fi, Ethernet, Zigbee or other networking protocols they choose.

Also important to the Ayla architecture's flexibility is that its services are stateless, meaning that all its data or state is maintained in a database in the cloud rather than on Ayla application servers. As a result, Ayla can add or remove a server without concern that a particular server is servicing a particular product. Servers do not need to keep track of clients; it's all handled in the cloud.

It lets manufacturers get to market with connected products—without having to write any code or learn any of the technologies required for connectivity or participation in the IoT.

One of the most important design directives for the Ayla Platform is that it does not require manufacturers to write any custom code, no matter what kind of products they make. Through its generic platform approach, Ayla delivers production-quality software that is production-ready and usable by manufacturers of any device or product.

Ayla offers a 'black box' solution that encompasses nearly all the code needed to create and deploy a connected product.

For most manufacturers, the host application functionality already exists and might have existed for years. The Ayla solution delivers everything necessary to turn any kind of host application into a connected product.

Ayla's embedded agent comes pre-loaded into the communication chip that is designed directly into the product, providing all of the code needed for connectivity. Because the Ayla black-box code is already tested and production-ready, it means that manufacturers do not need to expend time, or resources writing any connectivity-related custom code themselves. Instead, they can focus on what they do best.

The black-box approach also enables OEMs to create very efficient product development pipelines for similar kinds of connected products, because they don't have to recreate custom code for each kind of device.

It scales: in kind, in volume, in performance and reliability, over distance, over time.
The term 'scale' most often is associated with growing in capacity or number. But because the Ayla platform is built on the cloud, it can scale dynamically in multiple directions.

For instance, it scales:

- **In kind: To support different use cases, different markets, different kinds of products and devices—without knowing ahead of time what particular features or functionality will be needed—by connecting via the Ayla cloud rather than by connecting directly to multiple devices or services**

- **In volume: To support millions or billions of connected products and users by adding servers as opposed to getting a bigger server (i.e., horizontal rather than vertical scaling)**

- **In performance and reliability: Through secure over-the-air updates that keep connected products performing reliably and securely**

- **Over distance: By connecting Ayla clouds to other secure clouds, globally**

- **Over time: By learning and evolving—yet remaining 'generic' to any kind of device type —as needed to serve the evolving needs of manufacturers**

It transcends arguments about where intelligence should reside in the IoT.
In the Ayla architecture, the cloud is the master. As a result, devices can be smart or they can be dumb—in which case they can 'catch' intelligence from the cloud as needed.

One example is the concept of scheduling. Many IoT connected devices require a schedule, and there are many parameters that must be considered for effective scheduling. For instance, if an IoT-connected sprinkler system is on and the system loses connectivity, it is important that the sprinkler doesn't stay on indefinitely. Ayla architected its platform so that users can configure the schedule in the cloud, but then the cloud downloads the schedule to the device and the device executes the schedule without needing to be connected.

Another example is determining the local time of a device, which can be important for many kinds of daily or seasonal controls. The Ayla platform has three different methods to figure out the location of a device; an algorithm determines which of these three methods provides the most accurate location for that particular device.

Business logic is retained in the cloud. The Ayla cloud includes a rules engine, enabling a device– or cloud–based event to influence another event, which is important because it enables the manufacturers to automate certain conditions and events, some of which can also be configurable (within pre-determined parameters) by end users.

For example, the manufacturer of a kitchen range can set a rule that if an oven door is left open for 2 minutes during the cook cycle, the range sends a message to the user's mobile app to close the oven door.

The Ayla cloud also includes a statistics engine that can automatically generate particular statistics on a connected product, without requiring custom code to be written for either the device or the cloud. Manufacturers can, for instance, count the average, maximum, minimum, and or frequency at which a user performs some kind of behavior with their product.

It provides manufacturers with inherent incentives to create connected devices.

For some device manufacturers, connectivity is a given. For many other manufacturers, however, it might not be obvious why they need to turn their perfectly well-performing products into connected products.

By lowering the barriers to connectivity, Ayla greatly reduces the risk, expense and hassle of turning a traditional product into an IoT connected product. In some cases, this might be enough incentive for a manufacturer.

Longer term, however, Ayla sees benefits to manufacturers that go well beyond appealing to consumers' desires for IoT products.

When manufacturers gain real-world knowledge about how their products are actually being used—possible only through data generated by connected devices—they can improve multiple aspects of their business.

For example, they might:

- **Redesign warranty programs to be better for themselves and their customers**

- **Improve service and maintenance by replacing parts before they fail**

- **Iterate the actual design of their products over time, to more closely match what consumers want to buy**

- **Change their business models to be more efficient and attractive to consumers**

- **Generate new revenue streams through additional services or features**

It plays well with others, and it keeps the future in mind.

As a company, Ayla adopts a cooperative rather than a competitive approach when it comes to connectivity. Ayla supports industry standards and participates in consortiums important for IoT connectivity.

Ayla is also building a rich ecosystem of partners in areas compatible with all aspects of IoT. In Ayla's view, cloud-to-cloud integration is the natural way for adding service offerings to an IoT solution. The company continues to invest in building out its ecosystem and having technology that makes it very easy for third parties to talk to Ayla services, and for Ayla to talk to others' services.

No one has a crystal ball to see what kinds of technologies and market opportunities will be important in the future. To future-proof its platform, Ayla includes support for all the protocols and standards important for its current customers, and it monitors new protocols and standards and adds support as needed.

Ayla Networks

Ayla Networks provides the industry's first Agile IoT Platform, accelerating development, support, and ongoing enhancements of connected products for the Internet of Things. Ayla's software fabric runs across devices, cloud, and apps to create secure connectivity, data analytics, and feature-rich customer experiences. Offered as a cloud platform-as-a-service (PaaS), Ayla's flexibility and modularity enables rapid changes to practically any type of device, cloud, and app environment.