



Technologies That *Enable* a **Connected World**

Integrated Networking Technology Tools That Add Compatibility and Communication Connectivity To Heterogeneous Devices and Services





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OFFICES AROUND THE WORLD

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Product Data Sheet

Prepared by Atinav, Inc.

Introduction

The software technologies continue to move at a rapid pace and the Internet is the major driving force in this huge expansion. There is a virtual explosion in high-speed wireless connectivity with regard to Internet also. In a few short years, technology has moved from static pages which were commonly accessed using telephone lines to dynamic, content-rich sites which can be accessed by higher bandwidth networks and many wireless devices. Demand for remote connectivity to the office, home and customer is increasing and aveLink addresses this need.

With increased connectivity and the need for quick decision-making, the need to quickly implement actions and decisions through smart devices of various types and configurations will present new challenges and inhibitors. aveLink anticipates and solves many of the new problems of interoperability and heterogeneity of devices entering the market and workplace.

What is aveLink

aveLink creates a virtual network of heterogeneous devices and also allows the service providers to deliver their service in the virtual network. It also allows heterogeneous devices or services to communicate with each other, use the functionality offered by each and enable accessibility from browser/non-browser based clients through any type of network. These devices and services can use different technologies such as JINI, UPnP etc and connect through different networking mechanisms such as Bluetooth, Home RF, and IEEE 802.11, TCP etc. aveLink allows them to form a network and exposes them to the Internet, LAN/WAN or wireless network.

aveLink has two physical components--aveLink Server and aveLink Embedded Gateway. aveLink Embedded Gateway is based on the OSGi (Open Services Gateway Initiative) framework standard. The aveLink Embedded Gateway device interconnects the external wired or wireless Internet and the internal home or office network and enables the user to exploit those services and devices offered in the home, office and the Internet. The aveLink server forms a network of connected Embedded Gateways and allows centralized control of users, services and devices. In addition, aveLink contains a Development Platform that enables developers to easily create services and solutions without having to understand the underlying technology.

Home and small office environments are the first markets for interoperability systems. aveLink technology allows companies to deliver products that are easy for the consumer to install and operate. PCs, printers, scanners, intelligent handheld devices, DSL modems, and set top boxes, to name a few, will be some of the first devices to exploit this technology. aveLink simplifies communication between intelligent devices, thereby making the 'Linked World' of the future a reality today. This technology could be used with home automation, office automation, resource management, or automobile automation.

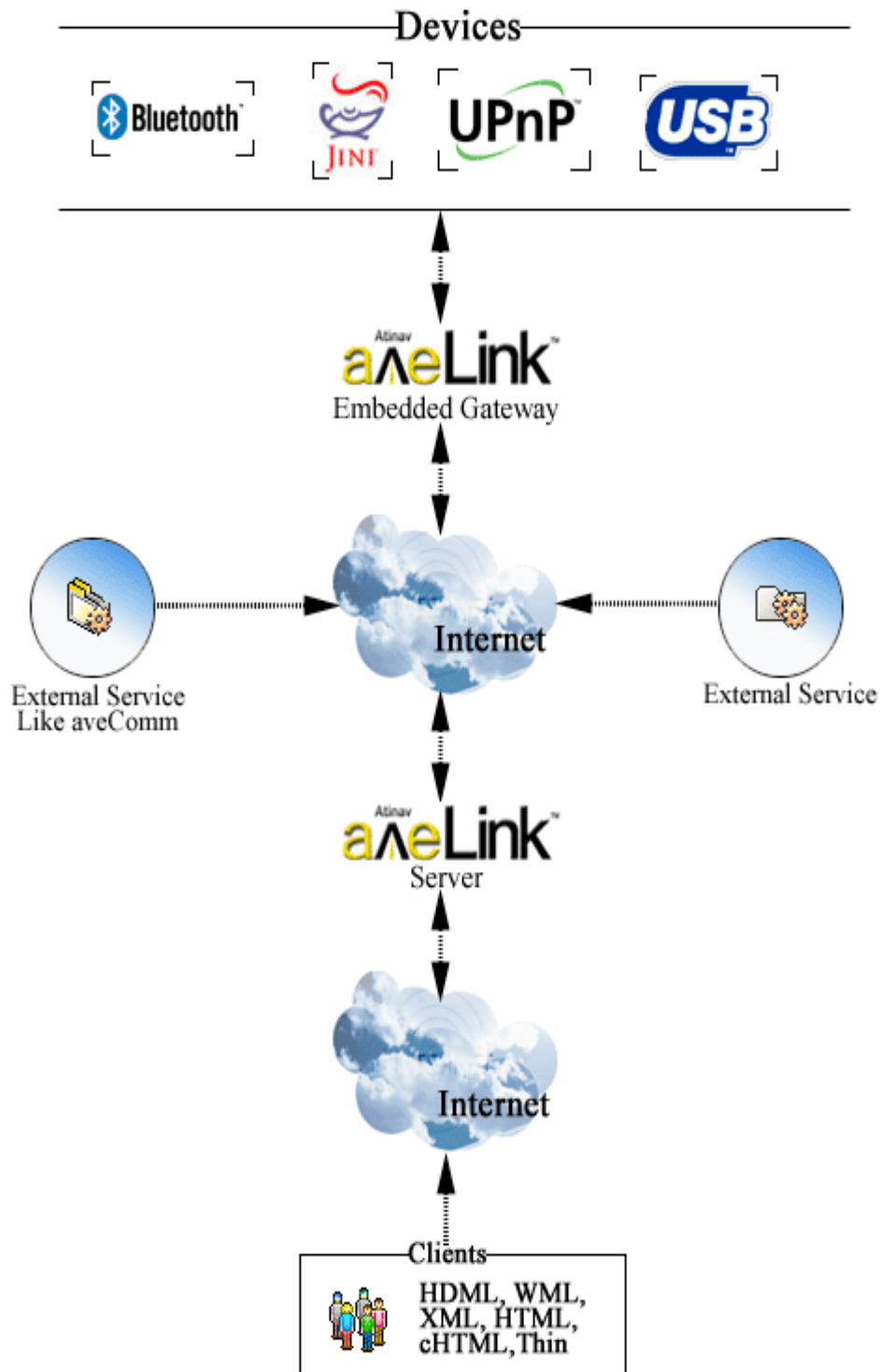


Figure 1: aveLink System

Linked World Concept

aveLink provides a 'Linked World,' enabling users to consult, complete transactions or communicate with people in different geographical areas regardless of the technologies they use. aveLink acts as a virtual network comprised of various technologies that work together and share information and services. The 'Linked World' can even include devices that are not compatible with TCP/IP networks.

Supported Technologies

The current version of aveLink supports device technologies such as Bluetooth, JINI, and UPnP. Supported network technologies include TCP/IP and Bluetooth. The aveLink framework contains a fully implemented WAP Gateway and support for I-Mode and SMS.

What is OSGi

The Open Services Gateway Initiative (OSGi) was founded in March, 1999, with the objective of providing a forum for the development of open specifications for the delivery of multiple services over wide-area networks to local networks and devices. The OSGi accelerates the demand for products and services based on those specifications worldwide through the sponsorship of market and user education programs.

The Open Services Gateway specification is a Java based application layer framework that gives service providers, network operators, device makers, and appliance manufacturers vendor neutral application and device layer APIs and functions.

This strategy enables virtually all emerging home networking platforms, protocols and services to seamlessly interoperate with back-end services using existing telephone, cable TV, or electrical wiring. Below are the key characteristics for the Open Services Gateway Specification:

- The technology needs to be platform independent so that it can be implemented on a variety of computing, communications, consumer electronic and household products and platforms.
- The technology needs to be standardized to provide vendors and service providers a common platform to work from and to ensure competition in the marketplace.
- The technology must have feature advanced security and integrity technology as multiple service providers and network operators may manage different objects or attributes in the Open Services Gateway device or inside the facility to which it connects.
- The technology must not force absolute or specific requirements on downstream network technologies, services or protocols. Any vendor must be free to use whatever technology applicable to their market.
- The technology must be reliable. The services gateway must be available at all times and not prone to crashes whether intentionally or unintentionally caused.

The Open Services Gateway Initiative technology is an important standard because the Open Services Gateway specification focuses exclusively on providing an open application layer and gateway interface for service gateways; it complements and enhances virtually all current residential networking standards and initiatives. Some of these include JINI, Bluetooth, CAL, CEBus, HAVi, Home API, HomePNA, HomePnP, HomeRF, and VESA.

The Open Services Gateway Specification also preserves consumer investment in future smart home devices. Today, a consumer switches from one home security provider to another, the entire internal network has to be replaced. By choosing devices compatible with the Open Services Gateway specification, consumers can switch between multiple vendor offerings with virtually no need to replace any of the existing networking infrastructures.

- The OSGi is a collection of APIs that define standards for a service gateway. These APIs define a set of core and optional APIs that together define an OSGi compliant gateway. The OSGi leverages existing Java standards, such as JINI and JDBC whenever possible. Where non-Java standards apply, the OSGi focuses on integrating with these standards.
- The core APIs address service delivery, dependency and life cycle management, resource management, remote service administration, and device management. All of the core APIs are either contributed by a member or developed by the OSGi technical working groups.

The optional set of APIs defines mechanisms for client interaction with the gateway and data for management. In addition, several existing Java APIs are included in the optional services. This includes JINI and several other Java standards. Vendors implementing OSGi specifications are not required to implement all optional APIs, though the implementation certification will reflect this. Use of optional standards is mandatory for implementation of capabilities for which these standards exist.

aveLink Embedded Gateway

aveLink Embedded Gateway is based on the OSGi framework standard. The aveLink Embedded Gateway device interconnects the external wired or wireless Internet with the internal home or office network and enables the user to exploit the services and devices offered in the home, office and the Internet. Networking technology can include LAN, WAN and home networks based on TCP/IP, Bluetooth, HomeRF and others.

Many devices can be connected to the Embedded Gateway. The Embedded Gateway exposes devices and services from the internal network to the outside world, making it an important component in the Linked World. Authorized users can access devices and services on their home or remote office systems from anywhere.

The Embedded Gateway separates the topology into the external network and the internal network. Services are delivered from trusted service providers on the external network and are delivered to the Embedded Gateway or internal clients. The services provided by the devices in the internal network can be accessed through the Embedded Gateway. The Embedded Gateway is typically a zero-admin system that is secure and functions as an ingress between these internal and external components. The OSGi specification includes APIs to manage, comprehensive life cycle management; inter service dependencies, data management, device management, client access, resource management, and security. Using these APIs, clients load network-based services on demand from the service provider, while the Embedded Gateway manages the installation, versioning and configuration of these services. The Embedded Gateway provides easy methods for external applications to access the services offered by internal clients.

aveLink Embedded Gateways are connected to an aveLink Server through the Internet. This server maintains centralized control over all Embedded Gateways. Administrators of the system define access rights for users and control which service or device can be accessed. aveLink Embedded Gateway can be installed on any device that supports J2EE or J2ME.

The OSGi framework takes advantage of the Java's ability to download code from the network. It provides a rich and structured development platform for component-based architecture. The primary goal of the OSGi framework is to provide an environment that supports:

- Dynamic loads and updates of applications on the fly, without stopping the environment.
- Devices that have limited memory
- A concise and consistent component programming model for application developers
- The ability to manage dependencies between applications
- Scalability

The OSGi framework provides a life-cycle management system that permits developers to partition applications into small self-installable units. In this context, these applications are called bundles. Devices running the framework can download bundles on demand and remove them when they are no longer needed. When installed, a bundle can register any number of services to be shared with other bundles under control of the framework. The OSGi framework supports the management of scalability issues required by application developers. This support is critical, because the framework is designed to run in a variety of devices; the different hardware characteristics of the devices could affect the scale of services they are able to support. The framework supports the development and use of services of varying scale by decoupling a service's specification from its implementation.

By splitting the implementation of a service from its specification (its Java interface):

- Developers who create services can implement the same interface
- Developers can code against a Service's interface

For example, a logging service on a device with local persistent storage (e.g. hard disk) will be able to store messages on the device, while on a disk-less device, the entries are saved remotely. The developers of the two logging service implementations can use the same interface; the developers of services that use a logging service write code against the logging service interface, regardless of the device implementation their service might use. The OSGi framework can fully hide and manage the different implementations from the bundles that use the service.

Supported Services

The following are some of the general services supported by the Embedded Gateway.

Administration Services

The Administration Service is a powerful feature of the system. This service allows administrators to start, stop and even change specific services that are available on the system without the need to stop or restart the server. This ensures that other services running on the system are not affected. This Administration Service can be accessed locally on the device for using any HTML, WML, cHTML (I-Mode), XML or HDML interface device.

Client Services

There are two Clients Services available within this service.

- FTP Service presents the client part of FTP so that any device in the network will be able to use this service
- The Mail Client presents a mail service to applications and devices. It supports SMTP, POP3 and MIME

JINI Services

This service provides a JINI lookup service and an interoperability service. JINI services provide a lookup server for JINI services in the network. The lookup server stores information about the services and optionally the UI of the service. The interoperability service provides an option for non-JINI clients to access JINI services. The interoperability service allows service providers to define thin client UI for their services and creates the required proxy clients at runtime, enabling thin client access of the service.

UPnP Services

Implements the control point part of the UPnP service. This service enables 'bridging' between UPnP and non-UPnP devices.

WAP Service

This service provides the WML conversion mechanism of WAP by creating the WML pages for requests. Optionally this service can be bundled with a fully developed WAP Gateway. The WAP service has a Push Initiator component that can push content into the WAP devices that support this function.

Log Services

The Log Service maintains a log of all activities within the Embedded Gateway as defined by the OSGi Log Service specification.

Registry Services

The Registry Service stores service specific information.

aveLink Service

This service is a powerful feature of the aveLink system. It ensures that services available from the aveLink server is accessible to the client devices. It also ensures that services offered by the Embedded Gateways are accessible to other gateways and thin clients via the Internet. The service also allows thick clients to communicate with the gateway.

Device Access Services

The Device Access Service is used to access devices registered by the Embedded Gateway. This service provides access to various devices connected to the Embedded Gateway using technologies such as Bluetooth, UPnP, etc.

HTTP Service

The HTTP Service allows the client service to export resources through HTTP protocol.

Connection Manager Service

The Connection Manager Service provides the network services for all the other services. This includes socket handling, connection management, etc.

Thread Management Service

The Thread Management Service handles the thread management issues and can maintain a thread pool.

Remote Method Invocation Service (RMI)

The RMI Service provides support to other services.

Timer Service

Provides a Timer Service to other services.

Bluetooth Services

This service implements Bluetooth Profiles, which includes: Generic Access Profile, Serial Port Profiles, Service Discovery Application Profile, Generic Object Exchange Profile, File Transfer Protocol, Dial up networking Profiles, Synchronization Profiles, Object Push Profile, Fax Profile and LAN Access Profile.

User Administration Service

This service allows the management of users very efficiently. This is a new feature which has come up with OSGi 2.0 specification.

Permission Admin Framework Service

This service is also a new feature with Osgi 2.0 and it allows the management of the permission on each and every bundles.

Preference Service

This service provides a means for consistent data storage. This is also a new feature with OSGi 2.0 specification .

Service Tracker Service

This service is used to track other services.

Metatype Service

This service is used for describing data in the configuration object and it aids in creating the UI.

Along with these services aveLink Embedded Gateway offers the following utilities also.

1. Remote Admin Application
2. Remote Admin HTML Interface
3. Policy Editing Tool
4. A tool for creating XML files that stores the metatype information.

aveLink Server

The aveLink Server forms a network of connected Embedded Gateways and allows centralized control of users, services and devices. The aveLink Server stores information about the registered Embedded Gateways. By forming a network of Embedded Gateways, aveLink Server acts as a common access point and ensures services available from the aveLink Server are accessible to client devices. It also ensures services offered by the Embedded Gateways are accessible to other Embedded Gateways and thin clients via the Internet.

aveLink Server allows the centralized management of users, services and devices that are connected to the aveLink system. This information can be controlled locally on the server or remotely via the Internet using any HTML, WML, cHTML (I-Mode), XML or HDM interface device.

The aveLink Server functions as a place to register applications such as Voice Over IP. Authorized users of the system will be able to use this service through the aveLink Server.

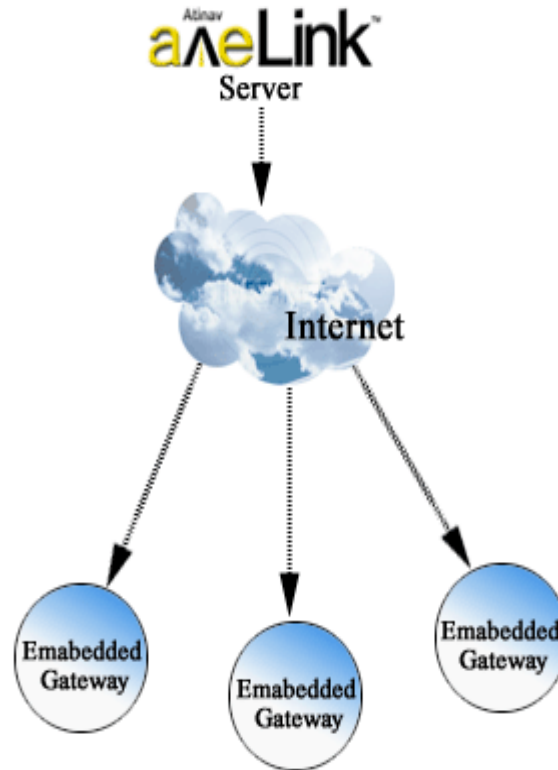


Figure 2: aveLink Server

The aveLink Server acts as the contact point for thin client services. A user can access any of the services using a standard browser hosted by the aveLink Server. The server authenticates the user by a user name and password and then displays the services and the Embedded Gateways that are accessible to that user. The user may select the desired service or gateway and will be presented with the appropriate service or device specific interface. The aveLink Server supports many access technologies such as HTTP, WAP, I-Mode, etc. The server allows authorized thick clients to access services that are available to the system.

Creation of this type of network explodes the number of opportunities available to service providers and application developers. For example, a company installs the Embedded Gateway in their branch offices. Any employee who enters one of the branch offices will be able to log onto the network through the Embedded Gateway available in that office. The employee with a Bluetooth enabled laptop will be able to access the office systems and the Internet. In addition, other users in the office can connect with him via Voice over IP as soon as the user is in the network. The examples are limitless.

Summarizing, aveLink Server offers the following functionalities:

- Forms a network of Embedded Gateways
- Manages the Embedded Gateways
- Keeps user account information for each Embedded Gateway
- Provides a common access point for all thin client users of aveLink (supports HTML, cHTML / I-Mode, WML, XML and HDML interfaces)
- Provides an access point for all thick clients of the system
- Forms a private network for the users of the system
- Hosts external applications and makes them available to all clients in the system
- Acts as a common point for access to all the devices in the Embedded Gateways irrespective of the technology or network standard used by the client devices
- Allows the external service providers to be a part of the virtual network

Development Platform

In addition to the aveLink Server and the Embedded Gateway, aveLink contains a Development Platform which can be used by developers to quickly create applications for aveLink or enable their existing applications such as Jini/UPnP service. This also allows the application developers to define the interoperability and UI for their services (both for thick and thin clients). The aveLink system makes the service accessible to thin and thick clients automatically.

Jini Development Platform

The Jini Development Platform allows developers to create Jini applications quickly and register them with the lookup server. The Development Platform contains everything required for developing Jini applications and making them interoperable with other applications.

The Jini Development Platform allows service providers to develop UI for JINI services. The service provider is allowed to attach one or more thick client user interfaces for a service. The UIs defined for a service are stored with the service information in the lookup server. Clients can use the service without creating a client application; all they need is a lookup browser.

Brief

1. The service provider develops a Jini application using the Jini Development Platform provided.
2. The service provider defines three UIs for that service using the Development Platform (for e.g. Swing, AWT and J2ME, the first UI will run on devices that support Swing, the second UI runs on all devices that support AWT and the last UI runs on all devices that support Java Micro edition.)
3. The service provider keeps the UI factory as an attribute with the service information and registers it with the lookup service of the Embedded Gateway. The device and Embedded Gateway can be connected virtually through any networking technology such as TCP/IP, Bluetooth, Home RF, USB, IEEE 802.11, etc. The Embedded Gateway handles all connection issues.

4. For a client to access this service, available services may be identified using a lookup browser provided by the Development Platform or aveLink Server. This can be done in two ways. Local clients (client belonging to the same Embedded Gateway) can directly browse the service from the local Embedded Gateway. Remote clients may access the service through the aveLink Server. The server verifies available services via the lookup server of the Embedded Gateway and displays them to the client.
5. The client can check the type of UI available and select it, suited to the capability of the device.
6. The selected UI is downloaded to the client device and executed, enabling easy client use of the service without having the service interface.

The Jini Development Platform allows Service Providers to make their service accessible to thin clients as well (WML, HTML, cHTML, XML or HDML). The Development Platform makes this possible by allowing the Service Provider to define an XML template for the service UI. The XML template contains the details of the UI as well as the information required for the state transition.

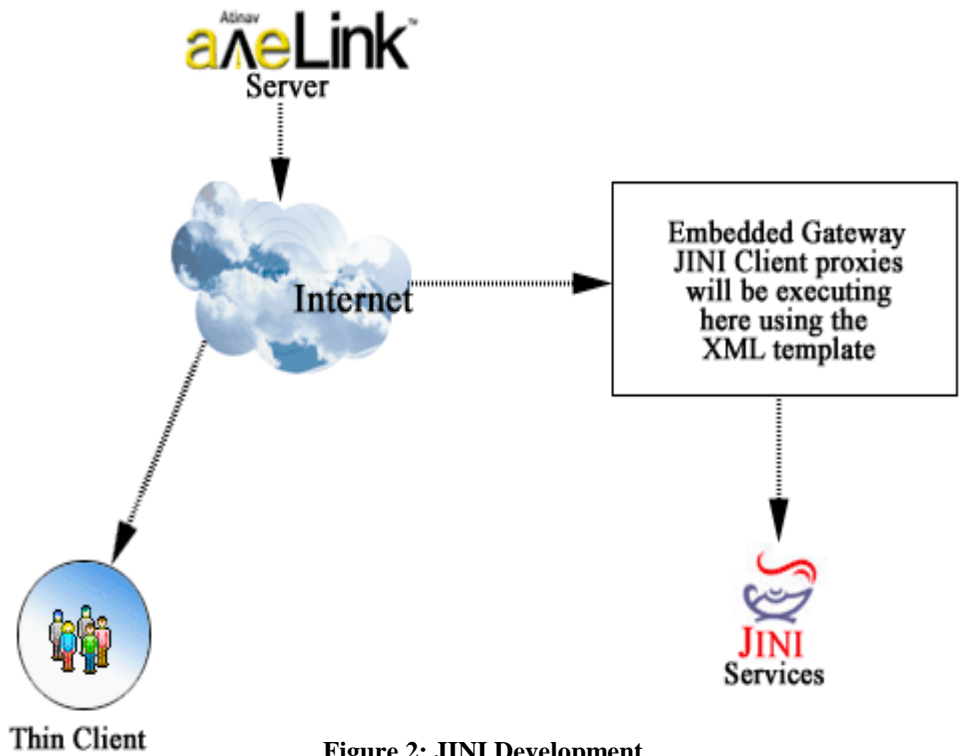


Figure 2: JINI Development

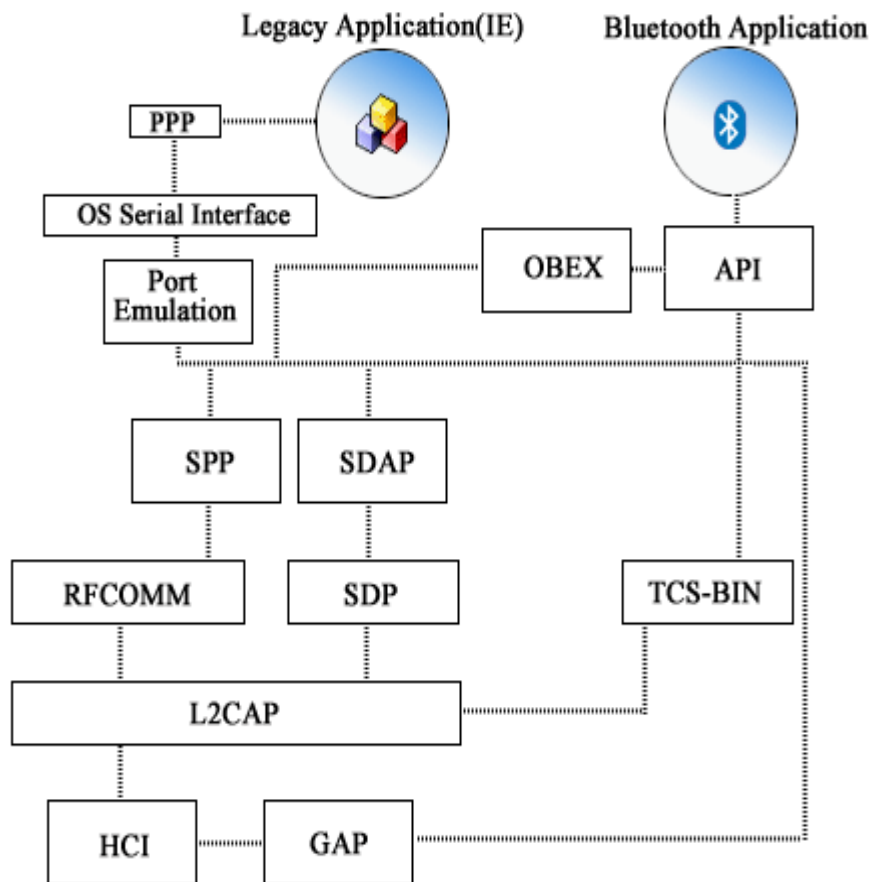
Bluetooth Development Platform

aveLink supports Bluetooth as a communication protocol in the Embedded Gateway. The Bluetooth devices within the range of the Embedded Gateway will be connected to aveLink. The Embedded Gateway contains a fully qualified Bluetooth Protocol Stack complete with Profiles so that any Bluetooth enabled device will be able to access the Embedded Gateway. Through the Embedded Gateway, the Bluetooth application can access the aveLink Server or any other accessible services in other Embedded Gateways. aveLink extends the use of the Bluetooth by integrating Bluetooth and the Internet.

The Bluetooth module of aveLink enables the following:

- Development of new profiles. This is achieved by exposing all the layers of the Stack to the developer
- Ability to create applications quickly by allowing access to all the profiles using exposed APIs

Bluetooth devices registered with a given Embedded Gateway will be able to use the services offered by the same Embedded Gateway and the services offered by any other Embedded Gateways in the system. Bluetooth services in the Embedded Gateway can be accessed remotely using Bluetooth clients as well as non-Bluetooth clients. The Bluetooth APIs supports JSR82 standard.



UPnP Development Platform

The Embedded Gateway supports UPnP services. The Development Platform includes a Device SDK, Control Point SDK and a Combined SDK. Using the protocol stack and Development Platform, developers can create UPnP devices that can be plugged in to an UPnP network. The Development Platform contains APIs, which expose different layers of the UPnP Protocol Stack. This ensures that the developer does not need to know the technical details of the stack and results in a quick and easy development process for creating UPnP devices. The control points can be used to view and control the devices.

Server Application

A UPnP server can be created quickly with the aveLink Development Platform. This application runs on the top of the Development Platform.

Development Platform API

The Development Platform abstracts the details of the core UPnP protocols away from the control point or service application and provides access to applications to the functionality in a unified interface. This helps developers to create UPnP applications without having to understand the underlying technology of SSDP, SOAP and GENA.

SSDP Module

SSDP Module implements the Simple Service Discovery Protocol. This is used in the Discovery phase of the UPnP. Using SSDP, the control points are able to send multicast searches for services and devices on the network and are able to receive replies to the searches. The module also allows servers to multicast announcements of their services to the network.

GENA Module

The GENA Module implements the General Event Notification Architecture. This provides UPnP with an event handling and notification mechanism. Clients (Control Points) use this mechanism for subscribing and un-subscribing to available services.

SOAP

The SOAP module implements the Simple Object Access Protocol, which provides the control phase of UPnP. Clients use this module for generating the required XML documents to retrieve or change the state tables of a service. The server uses this module for decoding the control requests and to generate the correct responses.

HTTP Layer

The HTTP layer provides common functionality for the higher layer modules. This layer retrieves the HTTP connections, determines which HTTP request is coming in, parses all the HTTP headers and transfers the connection to the appropriate protocol for processing.

XML Parser

The Development Platform has an XML Parser for parsing XML documents. UPnP uses XML extensively, in description, GENA uses XML to describe changes in service states, and SOAP uses XML to format requests and responses.

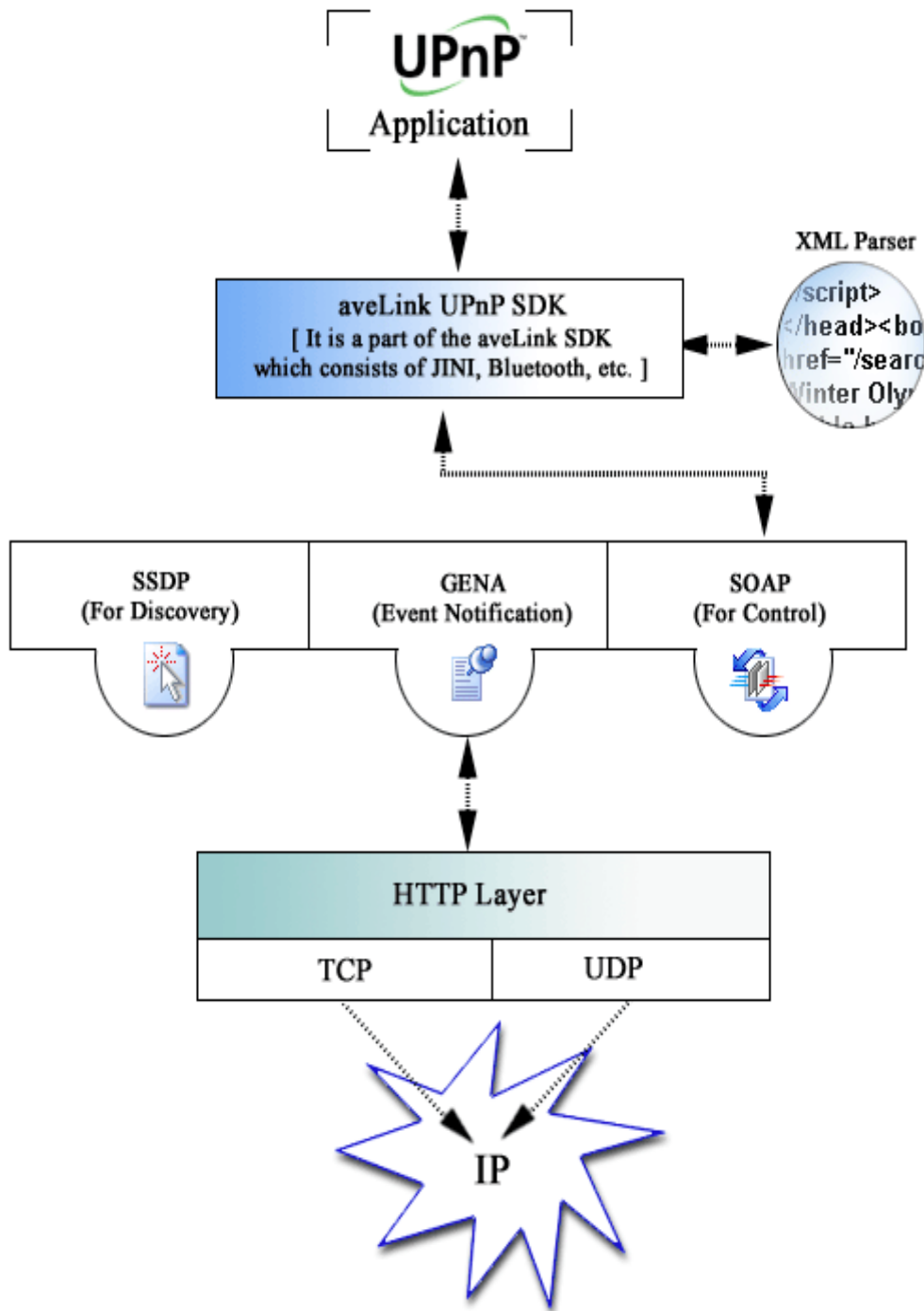


Figure 3: UPnP Architecture

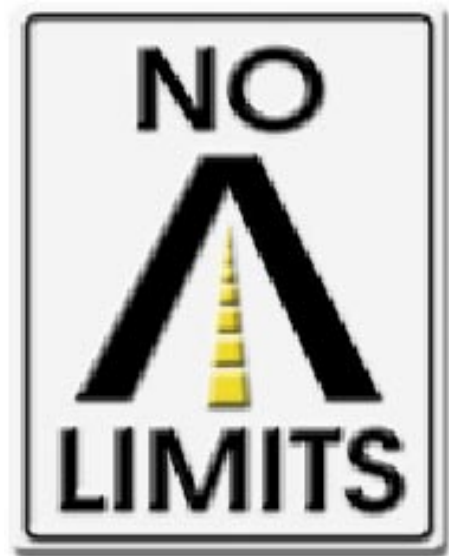
WAP Gateway

aveLink includes a WAP Gateway and a set of functions for creating WAP services easily. It has built in services such as mail and personalized profiles. With the APIs available, service providers can create WAP services. Interoperability components are also provided with the WAP service that ensures non-WAP services are available to WAP devices. The WAP service has a Push Initiator component that can push contents to WAP devices that support this function and to other technologies such as Jini.

For example, the Development Platform can make WAP Push, as a standard Jini service using the Jini Development Platform. As a result, any JINI device is able to push a WML page to the client. So, an administrative Jini service is able to Push a WML page to notify the administrator of a defined event.

Summary

1. **aveLink** creates a Linked World by integrating various technologies and providing an interface for connecting different networks.
2. **aveLink** provides a Development Platform for developing applications and makes them interoperable with other technologies.
3. The **aveLink** Server keeps track of all the Embedded Gateways and provides centralized control.
4. The Embedded Gateway acts as an interface between the Internet and the internal network.
5. The Jini Server module keeps track of registered Jini Services and the Jini Development Platform provides functions for registering services and makes them interoperable with other technologies.
6. Bluetooth Module provides a fully qualified Bluetooth Protocol stack, Profiles and a SDK for developing Bluetooth Applications.
7. **aveLink** comes with a standard built-in WAP Gateway.
8. The Development Platform associated with the **aveLink** WAP module helps to create WAP Services quickly.
9. The UPnP Development Platform allows the development of UPnP applications and makes them interoperable with other technologies.
10. Embedded Gateway has been developed to comply with the OSGi 2.0 standard.





aveLink™

Technologies That Enable a Connected World

Integrated Networking Technology Tools That Add Compatibility and Communication Connectivity To Heterogeneous Devices and Services

aveComm™

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