



White Paper
The Cloud®, RoamPoint™ and
Intel® Solution Services

The Cloud[®], RoamPoint[™] and Intel[®] Solution Services Deliver Protected Seamless Roaming for Enterprise Users

A pilot deployment at Stockholm railway station demonstrated the potential of 802.1X-based public Wi-Fi to deliver seamless, flexible and controlled remote access to corporate networks



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Executive Summary

The Cloud is one of Europe's leading Wi-Fi network providers with the largest number of hotspots; its network aggregator and interconnect business company RoamPoint; and Intel® Solution Services, Intel's professional services organization, have developed a public wireless local area network (WLAN) solution enabling business users to access their corporate networks through public Wi-Fi hotspots. The solution addresses existing enterprise security concerns as it is based on the 802.1X standard which blocks WLAN network activity until a user is successfully authenticated by a central authority.

The 802.1X standard has already been implemented by many enterprises for running private corporate WLANs. By extending its use to public WLANs and combining it with the International Roaming Access Protocols (IRAP) framework, the solution enables enterprise users to employ their normal enterprise log-on credentials for access when using public WLAN services provided by The Cloud. This simplifies the process for remote users and eliminates the need for IT departments to deploy VPNs to enable remote workers to use their corporate networks.

Following a Pilot at the Intel Solution Centre in Stockholm, Sweden the solution was successfully piloted at Stockholm Railway station. This set the basis for a nationwide deployment of 802.1X-based public Wi-Fi hotspots across Sweden in early 2006, which will be followed by deployments in Germany and the UK, enabling secure seamless roaming for enterprise users.

Simplifying Roaming Without Compromising Corporate Security

Wi-Fi technology enables users to wirelessly connect to the internet through a WLAN. Wi-Fi hotspots have become a common sight in almost any public space from airport lounges to public transport and the number of hotspots is rapidly increasing. The Cloud is one of Europe's leading Wi-Fi network with over 6,500 existing hotspot locations across the UK, Sweden and Germany and is continuing this growth by

currently opening more than 100 new locations each week across Germany, UK and Sweden.

The rapid expansion of Wi-Fi hotspots combined with the increased availability of devices optimised for wireless computing, such as those using Intel® Centrino® mobile technology, has revolutionized people's lives, providing them with access to information nearly anywhere, anytime. Business travelers and mobile workers are benefiting from the flexibility offered by mobile technologies and are using public Wi-Fi more frequently as the preferred choice for remote access to company information. However, despite increased usage, most Wi-Fi hotspots are still operated independently, leading to an inconsistent user experience in terms of quality and service charges.

In addition, the ability to securely access enterprise LANs while on the move remains a primary concern for most businesses. Corporate LANs are generally accessed by employees using conventional virtual private networks (VPNs) over the internet. To enable their employees remotely while ensuring the corporate LAN is secure, companies must set up remote accesses for their mobile workers on an individual basis. This can be a time-consuming, resource intensive process which often involves liaising with third party suppliers, as well as installing new software.

The growing user demand for secure and seamless access to corporate information while on the move prompted The Cloud to look for an innovative solution for enabling enterprise users to access corporate LANs safely and easily. The Cloud, its network aggregator and interconnect business company RoamPoint, and Intel® Solution Services collaborated to use their expertise to develop a solution based on the 802.1X standard and incorporate specifications defined by International Roaming Access Protocols (IRAP). The solution enables enterprise users to employ their usual business credentials for accessing corporate systems using public Wi-Fi services rather than using an 'open' network that is not secured in the same way that an office network would be. To ensure traffic is protected on an end-to-end basis, the solution should be used in conjunction with a VPN.

Secure Roaming for Corporate Networks

Today's business world requires many employees to travel extensively while still being able to communicate and work as flexibly and effectively as if they were in the office. The popularity of mobile devices highlights how communication requirements have changed. But this change does not come without added risks. Many industry reports highlight that the ability to securely access enterprise LANs while on the move remains the single most important issue for most Enterprises. The 802.1X standard enhances the security of WLANs by blocking any network activity until a central authority successfully authenticates the user. The standard is already widely used by businesses around the world to secure their corporate networks and manage and control user provisioning and authentication.

In an 802.1X-based WLAN, client access is controlled by the network based on authentication of the user by means of the Microsoft Active Directory* service, which supports Protected EAP (PEAP) based authentication. The authentication process is secured through standard Public Key Infrastructure (PKI) protocols. Client users negotiate authentication against the internal deployment of the Microsoft Internet Authentication Server* (IAS) – the implementation of a Remote Authentication Dial-in User Service (RADIUS) server and proxy – which proxies authentication requests to Microsoft Active Directory* and the certification authority.

The solution designed by The Cloud, RoamPoint and Intel® Solution Services effectively extends the capabilities of corporate 802.1X-based WLANs into the public environment while enabling businesses to control and maintain the policies associated for provisioning each user onto their internal private WLAN. Enterprises benefit from improved flexibility by using standard practices to enable remote access users simply by setting the appropriate parameters for each user's service profile that is

maintained within the enterprise systems. The whole process for managing user's requirements for remote access is simplified and can be less costly to set-up and maintain.

A Reference Point for the Industry

The first step in realizing The Cloud's goal of offering services for secure and seamless access to corporate WLANs using public Wi-Fi was through a POC conducted by Intel® Solution Services at its state-of-the-art Solution Center in Stockholm. During the POC, Intel's consultants used their technical insights and expertise to build and test The Cloud's new access network solution architecture and assess the new solution's compliance with the IRAP framework.

Supported by the successful results of the POC, the next step was a pilot deployment designed to establish a public 802.1X-based WLAN service at The Cloud's Stockholm railway station hotspot. This was planned as a precursor to rolling out a public 802.1X service across Sweden and other European countries in '06. The pilot enabled The Cloud's and Intel® Solution Services' employees to use the same credentials in the newly deployed access network as they use within in their respective companies.

The nine week pilot at the Stockholm railway station successfully demonstrated that The Cloud's public 802.1X network enabled users, who were provided with Intel® Centrino® mobile technology-based notebooks and privately provisioned with a native 802.1X Microsoft Windows XP PEAP* client, could securely access their corporate LAN using customary corporate credentials.

Business and Technical Benefits

When The Cloud's public 802.1X service is rolled out across Sweden at the beginning of 2006, it will alleviate many concerns for both mobile workers and IT managers. The service provides a simple and cost-effective way for users to benefit from mobile access to their corporate LANs.

- **Secure**

Security is the primary benefit of remote corporate access based on the use of 802.1X and a VPN to ensure traffic is protected throughout. The 802.1X standard enhances the security of corporate LANs by blocking any network activity until the user (regardless of whether they are connecting remotely or not) is successfully authenticated. Since all internet data traffic goes through the corporate firewall, the same security policies configured for use inside an 802.1X corporate LAN are applied onto 802.1X public WLANs reducing the potential security threats to corporate systems.

- **Flexible access**

The use of 802.1X over public WLANs eliminates the need to set up remote access for mobile workers. Enterprise users configured to access their corporate WLANs using 802.1X are set up and supported over standard IT processes, therefore reducing the pressure on the IT department by removing the need for bespoke solutions and lowering set-up and ongoing maintenance costs.

- **Seamless delivery**

The Cloud's 802.1X-based public Wi-Fi service is a seamless managed solution delivered with authentication, authorisation, billing and settlement. Those working far from the office will no longer have to purchase a temporary, geographically and time-restricted access credential for each individual Wi-Fi hotspot they use. Bills will be sent directly to the worker's company, eliminating the inconvenience and hassle of monitoring hotspot usage, collecting receipts and claiming back the connection time on expenses.

- **Control**

The ability to monitor usage is essential to ensure the integrity of the corporate IT network. Currently, enterprise users who access their corporate LANs from public hotspots do so via the internet. As a result there is a lack of control over which internet sites are visited and what content or

software is downloaded. 802.1X-based solutions for remote access over public WLANs extend the IT department's ability to monitor usage and enforce corporate policies for remote workers in the same way as with office-based users.

Collaborating and Innovating with Intel® Solution Services

The Cloud was fully supported by Intel® Solution Services, who understood the potential of using 802.1X and the technology behind it as a highly effective enterprise remote access solution. Intel has a long history of pioneering revolutionary technologies and as a result, Intel's professional services organization was able to provide its excellent technical knowledge and industry insight throughout the POC and piloting phases.

Intel Solution Services' expert consultants capitalised on Intel's position as a technology leader and innovative solution provider. Intel has a deep network of industry alliances it utilizes to develop comprehensive high performing solutions that are intended to deliver clear return on investment. Indeed, the company has first-hand experience in the benefits of development and deployment of WLANs as the primary network connectivity method. By making wireless an integral part of Intel's standard network infrastructure the company dramatically reduced capital and operational costs and increased employee flexibility, productivity and timesavings.

Additionally, the Intel consultants possessed outstanding expertise in the deployment of Intel® Centrino® mobile technology-based solutions, the widely adopted laptop technology in the enterprise. In both the POC and the Stockholm railway station pilot, Intel® Centrino® mobile technology-based notebooks were deployed to fully utilise the benefits of the WLAN.

Intel® Solution Services' involvement in this project included:

- Designing the access network architecture to support the co-existence of 802.1X security based access methods and Universal Access Methods (UAM).

- Assessing the solution to ensure compliance with the IRAP.
- Implementation of an IPsec (Internet protocol security) tunnel between Intel® Solution Services and The Cloud to enable Intel® Solution Services' consultants to use the 802.1X-based hotspot at Stockholm railway station for the duration of the pilot.
- Enable all users configured for remote access within the enterprise Microsoft Active Directory* domain to remotely access the enterprise LAN without the need to enter user credentials manually.
- Ensure the solution works for any user that is part of the Microsoft Active Directory* situated in the enterprise domain.
- Ensure solution compliance with IRAP specifications.

The Choice of Stockholm Railway Station

The Stockholm railway station pilot was designed to act as a precursor to The Cloud launching its public 802.1X-based Wi-Fi hotspots across Sweden, Germany and the UK in 2006. Stockholm railway station was selected because it offered a convenient location for both Intel® Solution Services and The Cloud.

Additionally, the Stockholm railway station was an optimal location because it is one of The Cloud's busiest hotspots in Sweden. Stockholm has a large and thriving technology based enterprise community and benefits from a very large number of visiting corporate professionals traveling from abroad. This location made it the right choice for deploying a pilot to test the functionality of the new service in a high demand area.

The technical objectives of the Stockholm railway station pilot can be summarised as follows:

- Enable automated log-on to provide a seamless experience for the user.
- Leverage existing deployments of 802.1X in private WLANs and utilise existing implementations of Microsoft Enterprise Windows Server* solutions.
- Allow the enterprise domain account operating over Microsoft Active Directory* to map the credentials of the PEAP client to the corporate IAS server provisioned with employees' account credentials.
- Allow all users to access the enterprise LAN from a public WLAN access platform based on The Cloud's own deployment of public 802.1X.

The Enterprise Benefits

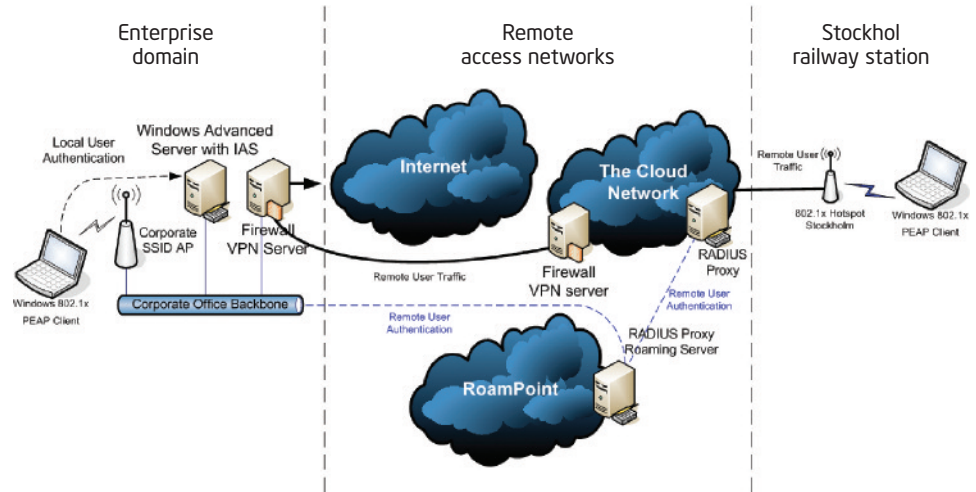
The pilot at Stockholm railway station demonstrated the benefits of accessing corporate systems through public Wi-Fi hotspots for both enterprises and end users. In 2006, The Cloud will start the deployment across its full network.

By the end of 2006, the service will be rolled out to an estimated 1,200 sites across the whole of Sweden including airports, hotels and business parks, as well as railway stations. Additional plans exist to enable the service across The Cloud's network in the UK, Germany and other Nordic regions in the same year. Through the RoamPoint subsidiary and because of the non-proprietary nature of the service, it may also be enabled globally across other Wireless Internet Service Provider (WISP) networks.

Mobile workers will benefit from a simplified and seamless access to their corporate networks, helping to raise productivity levels while working away from the office. Furthermore, The Cloud's new 802.1X-based access solution eliminates the need for setting up remote access for mobile workers and delivers far greater control for IT departments, enabling them to more effectively monitor and control their corporate LANs.

In addition, as the 802.1X standard becomes more widespread across the enterprise in the coming years, companies working together will be able to securely share information across their LANs.

Stockholm Railway Station Pilot: Technical Overview



The diagram above represents the Stockholm railway station pilot architecture in a schematised way. The solution is designed to use “off-the-shelf” standardised technology. It is based on using the native Windows XP* client configured as part of the Microsoft Active Directory* domain that hosts the user accounts. The access network supports 802.1X and IPsec to allow the enterprise credentials to be securely transmitted first over the air interface and secondly over the internet back to The Cloud’s network. RADIUS platform realm routing is used by The Cloud to forward the user credentials to the relevant enterprise RADIUS server where authentication is performed.

The overall solution design is based on a Master–Slave configuration. The solution architecture employs virtual LAN (VLAN) technology to create two logically separated networks inside the solution – one network for the 802.1X traffic and one network for the open, UAM, network.

The Master device (the Ericsson ABS* 2200 managed as part of the RoamPoint service from the Stockholm hotspot) contains the relevant configuration to handle the internet backhaul connection (over a DSL link) for the whole solution. It also employs two IPsec tunnels (one per VLAN) and Dynamic Host Configuration Protocol (DHCP) Relay settings (one relay per VLAN) for routing and security purposes when relaying traffic to The Cloud’s network.

In addition, the Master provides WLAN connectivity for clients, just as the Slaves do. The Master is configured with two wireless ports, where one port is configured for 802.1X secure access and the other port is configured for open, or UAM-based, access. Both WLAN ports broadcast their own service set identifier (SSID) using ESSID (Extended Service Set Identifier) technology. Each WLAN interface is further mapped onto a unique VLAN in order to separate, and prioritise, the traffic inside the solution. The VLAN technology is based on 802.1Q, a standard that defines the operation of VLAN.

The Ericsson ABS* 2200 Slave device contains the relevant configuration to manage the WLAN client access. It is configured with two WLANs and each WLAN is attached to a specific VLAN for traffic separation. VLAN tagged data is sent over the WAN (Wide Area Network) port to the LAN port of the Master device where it is routed through IPsec tunnels to The Cloud’s network.

Intel® Solution Services developed a solution using Master-Slave architecture which allows for connecting up to three Slave devices directly to the Master as the Ericsson ABS* 2200 has three LAN ports. Each Slave can further connect up to three more Slaves on its LAN ports and so forth. This enables the innovative solution to be flexible and scalable and allows for any type of deployment scenario, from small targeted deployments to large user base installations.

Stockholm Railway Station Pilot: Solution Summary

In the Stockholm pilot, the same enterprise infrastructure managing the provisioning and security associated with allowing each user onto a corporate 802.1X network was enabled in a public WLAN environment using the RoamPoint platform. By using the 802.1X standard in the public WLAN, it is possible for enterprises to deal with the authentication of remote users in the same way as with office-based users.

Intel® Solution Services uses its foremost expertise in architecture and next-generation technologies to design cost-effective, cutting-edge solutions. This solution is based on enabling the RoamPoint platform to proxy all relevant authentication requests to the Microsoft Enterprise Server*. In this way, authentication is seamless, immediate and the user log-on procedure is exactly the same as for normal enterprise access. Furthermore, connectivity is instantaneous since the RoamPoint platform manages the authentication process between the public WLAN environment and the private WLAN environment.

With the application of the 802.1X standard in public WLANs, IT departments can define the remote access profiles for all users configured on their internal Microsoft Enterprise Windows Servers, which will be instantly enabled on the RoamPoint service when a user requests access from a public WLAN.

Since the solution works independently of any other remote access clients in use by the enterprise (because it uses the embedded capabilities of the 802.1X Microsoft XP* client), enterprises are able to leverage the benefits of public WLAN for remote access without relying entirely on a third-party remote access service. Intel® Solution Services architecture expertise, state-of-the-art facilities, and strong industry alliances helped deliver a highly efficient solution to help businesses get the most out of their information technology investments.

Summary

Business demand for seamless and secure wireless connectivity will offer significant business opportunities for wireless service providers over the next few years, as the ability for companies to keep mobile workers connected to and interacting with the corporate infrastructure is essential to business survival. The Stockholm railway station pilot represents a major focus in implementing mobile technologies in the business sphere and offers a reference point for the industry.

With this deployment, The Cloud, RoamPoint and Intel® Solution Services have reaffirmed their commitment to fostering progress in wireless mobility through technology innovation that looks to deliver a clear return on investment. They have raised the bar by delivering roaming for the enterprise into public Wi-Fi networks using companies' preferred security methods. It offers businesses the opportunity to improve security and work flexibility, increase productivity and remain competitive.

Take Advantage of Mobile Technologies

Learn more about how Intel technologies and Intel® Solution Services can help you transform your business.

For further information, talk with your Intel representative or visit us on the web:

Information about Intel® Centrino® mobile technology:

<http://www.intel.com/products/laptop/index.htm>

Information about Intel Solution Services:

<http://www.intel.com/go/intelsolutionservices>

About Cloud

The Cloud offers sophisticated national wireless LAN coverage in nearly 7,000 hotspot locations throughout the UK, Sweden and Germany. The Cloud's infrastructure is a multi-service provider platform, which allows providers such as ISPs, mobile operators and cable companies to offer a fully branded wireless LAN experience to their customers. With The Cloud, site owners maximise their revenue potential by supporting all major service providers at their location and customers enjoy the best possible experience and maximum ease of use.

The company is opening more than 100 new locations each week. Launched in mid 2003, The Cloud actively partners with O2, BT, Skype, Ericsson and Intel among others to facilitate the growth of wireless broadband services across Europe. The Cloud's investors include 3i and Accel Partners, Europe.

About RoamPoint

RoamPoint is a global WLAN roaming hub and aggregator, providing global network interconnectivity between Service Providers and WLAN operators. RoamPoint enables a consistent customer-branded user experience to their end users, a single and simple point of integration to networks and provides access to settlement and clearing house services.

About Intel

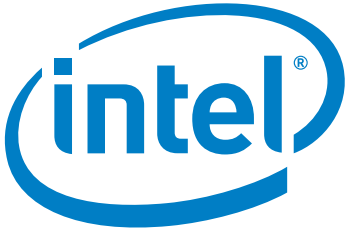
Intel, the world's largest chip maker, is also a leading manufacturer of computer, networking and communications products. Additional information about Intel is available at www.intel.com/pressroom

About Intel® Solution Services

Intel® Solution Services is Intel's worldwide professional services organisation, helping communities and businesses around the world implement and manage new wireless and mobility initiatives. To help make wireless and mobility deployments a reality, Intel® Solution Services consultants work to:

- Assess goals and requirements through personalised workshops
- Recommend current and future mobile and wireless technologies based on proven knowledge and experience
- Develop strategies for business models and short- and long-term network development
- Design and deploy comprehensive solutions using state-of-the-art design and testing facilities

Intel® Solution Services consultants have end-to-end expertise in designing, building, implementing and optimising solutions on Intel® architecture. The consultants are certified network, software, database and systems engineers and are experts in optimising the efficiency of existing computing environments and implementing leading-edge technologies.



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