An Introduction to NetReady™

Version 3.0.0

For SDK Release 3.0.0

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Thank you for using the UpdateLogic NetReady™ Service Management System. UpdateLogic provides comprehensive, cost-effective services which allow remote support sessions, software and firmware updates and secure field provisioning of DRM keys in all types of Internet enabled CE devices.

If you find any problems with this software, please report them via email to techsupport@updatelogic.com.

Please visit our website at www.updatelogic.com for the latest news and information.

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1 Overview

For over 50 years, the television industry has been operating on analog technology. Analog televisions contain little or no computational abilities, and have therefore been sold and marketed much the same as a dishwasher or any other home appliance. With the advent of high definition digital content, low-cost digital circuitry that supports Internet connections, and the ubiquity of streaming media services, the digital age is reaching the most powerful of all home appliances, the TV.

The connected devices such as TVs and Blu-ray players will soon compete with the home computer as the most complex device in the home. Software updates, the provisioning of streaming media security credentials, remote support facilities are now all a part of modern connected CE devices. UpdateLogic's NetReady technology provides all of these services.

1.1 Change Tracking

Version Number of This Document	Changes
3.0.0	First 3.0 release

1.2 Scope

This document provides an introduction to the NetReady suite of services, the UpdateLogic network, the NetReady Device Agent ("the Agent"), and the SDK tools. The associated SDK documentation provides all the necessary information to integrate the Agent into an Internet-connected CE device .

As a technical overview this document provides answers to the most commonly asked NetReady Agent, network, and SDK questions. Readers should be well versed in digital television technology including digital receiver architecture, Internet protocols, and embedded software development.

Note: Each release of this document is coordinated with a specific SDK release. Make sure you are working with the appropriate SDK release.

1.3 Audience

This document is designed to be read by all parties interested in the NetReady suite of services including management, technical, compliance, quality assurance, and marketing personnel.

2 Introduction

NetReady is a suite of technologies that enable a CE manufacturer to run remote support sessions, update the software, data, and security credentials of a TV after it ships, store registration information, and acquire real-time diagnostic information to help troubleshoot problems. Each of these technologies is independent of the other. In order to use one you do not have to include the others. This section provides a brief synopsis for each of these technologies.

2.1 SupportTV

SupportTV is an optional feature set of the Agent that allows the device to engage in live remote support sessions whereby authorized technical support personnel can access the device in real-time over the Internet via a web browser.

For more information on SupportTV please see the overview section below or the *SupportTV Technical Guide.*

2.2 UpdateTV

UpdateTV is an optional feature set of the UpdateLogic Agent that is responsible for adding features and providing bug fixes after a connected CE device has shipped. UpdateTV takes advantage of three types of update delivery mechanisms: Internet, Broadcast, and USB.

For more information on UpdateTV please see the overview section below or the *UpdateTV Technical Guide.*

2.3 SecureTV

SecureTV is an optional feature set of the Agent that securely delivers streaming media authentication and encryption keys to connected CE device in a consumer's home. SecureTV can deliver any device-unique data to a connected CE device including SSL certificates, proprietary DRM authentication files, or e-commerce identity tokens. This data is initially delivered when the device first connects to the Internet in the consumer's home and again as necessary when a key expires or needs to be revoked and renewed due to compromise or upgrade. New keys for services and applications that are added after an appliance is shipped can be introduced as well.

For more information on SecureTV please see the overview section below or the *SecureTV Technical Guide.*

3 The NetReady Services

This section provides an overview of some of the details for each of the NetReady services.

3.1 SupportTV Overview

SupportTV live support sessions are initiated by the end user on the device. Upon initiation, the UpdateLogic Agent establishes a secure (HTTPS) bi-directional communication path over the Internet to the UpdateLogic NOC Services and receives a one-time-use session code. The device then awaits a connection from a support technician. Status about the connection is readily available from the UpdateLogic Agent interface for display to the end user.

The end user must convey the session code to the support technician, typically over the existing support phone conversation. The session code is all numeric, random and consistent across all devices. The technician enters the session code using a web browser logged into the UpdateLogic NOC Services which then relays activity between the device and the technician's web browser interface.

Use of the NOC Services between the device and technician interface facilitates reliable network communication despite varying device and technician local networking environments that may include routers, firewalls, Network Address Translation (NAT) and proxy servers. Also, the NOC Services facilitates optional integration of the SupportTV session with UpdateTV and SecureTV capabilities, if supported by the device.

During the live support session, the device largely reacts to commands initiated by the technician interface through the NOC Services. For example, data is retrieved, commands are executed and video is streamed from the device to the technician's display. Together, the commands and their responses are used to inspect and manage the device remotely.

The diagram below outlines the SupportTV process.
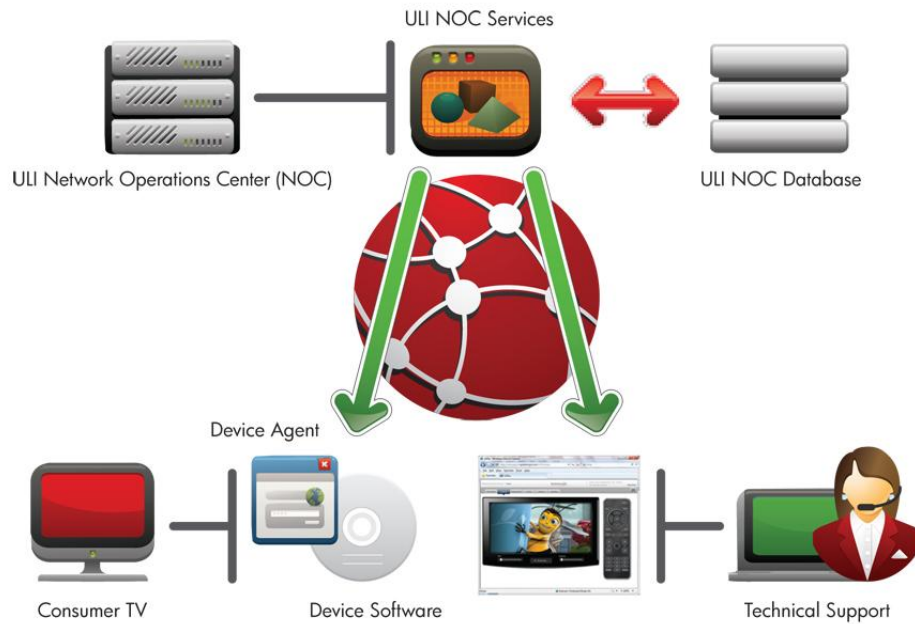
3.1.1 Control Path

A pre-defined set of commands is exchanged between the support technician's interface running within a web browser and the connected CE device. This command set can be dynamically extended. At run-time, the device can optionally register custom commands with the Agent that will be conveyed to the NOC Services and technician interface, where they are made available for invocation. Custom commands do not have to be pre-registered with the UpdateLogic NOC Services at design-time.

3.1.2 Streaming A/V Path

The device may be instructed to provide an output video stream of its display for consumption by the technician interface. The Agent implements all scaling, compression, encoding, buffering and network streaming associated with the video stream. The device need only provide periodic raw screen captures upon demand (callback) from the Agent. Various parameters such as the maximum supported frame-rate are configurable.

The content of the screen captures is device dependent, and may contain generated ("graphics plane") content and/or source ("video plane") content.

3.2 UpdateTV Overview

Internet and broadcast updating occurs automatically and invisibly when the TV is powered off using the remote's power key. Due to concerns about simplifying the support matrix and security agreements with streaming media partners there is no way for a TV update to be rolled back. It's a one-way operation. If bugs are found in a recent update another update will be made to fix those bugs and the system will be updated again. When an update is complete the user will be notified that their TV software has been updated and the version string and a brief release note will be displayed. The current version string is usually displayed in a user menu. If a TV is left powered up then it will not receive updates.

The diagram below outlines the update process.

3.2.1 Internet Updates

When the TV is powered down it checks for Internet updates first. The time an Internet update takes to complete is dependent on the size of an update and the consumer's Internet connection speed.

3.2.2 Broadcast Updates

If the UpdateLogic NOC cannot be reached to check for an Internet download the Agent can be configured to receive a terrestrial or cable broadcast update. The best case time for delivering a broadcast update is 2.5 hours. The worse case time is 5.5 hours given the current load on the UpdateTV broadcast carousel. If the TV is power on during a broadcast update it saves the amount of data that it has received so far. When the TV is then powered down again the broadcast update picks up where it last left off. On TVs that are left powered up and down many times per day it may take a few days for the TV to receive an update. Updates do not affect the function of the TV until all of the parts of the update are received. Broadcast update channels are identified during the channel scan that takes place during onboarding. If a TV is moved to another city, the channel that the broadcast Internet updates occur automatically when the TV is shut off.

3.2.3 USB Updates

Updates can be delivered by USB. A consumer may download an update from a website and place it on the USB themselves or a USB stick can be mailed to them directly from the CEM. USB updates are unlike broadcast and Internet updates because they're initiated by plugging a USB stick into the TV when the TV is powered-up. The TV will check the USB stick for a new update and if it finds one it will tell the consumer about the version of the update it just found and will then power down automatically to receive the update. USB updates take 45 seconds to complete although the total time will be a little more because the TV has to power down to get the update and then power back up to install it once it's been received.

3.3 SecureTV Overview

SecureTV takes a Swiss bank account approach to the objects it provisions. Provisioned objects are considered to be *opaque*. Their contents and operation do not need to be exposed to SecureTV. The only exception to this is when the DRM provider shares the contents of those objects so that ULI can generate and encrypt them. If the objects are not shared they will be encrypted as is. Objects are imported to the NOC only after they are encrypted. They are then securely delivered to the device when that device registers with the NOC. On the device the objects are delivered only to a requesting authenticated client. At no point does SecureTV need to understand what the provisioned objects are used for or become involved in the DRM they support.

The diagram below outlines the SecureTV provisioning process.

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3.3.1 Chain of Trust

SecureTV's cryptographic chain of trust is always anchored in a SoC-specific hardware protected key called the root of trust key. The implementation of this key differs from one SoC to the next. UpdateLogic certifies each SoC-specific chain of trust with all of our content service provider partners.

4 The NetReady SDK

The NetReady SDK is delivered in three different installation packages: one for the tools, one for the documentation, and one for the Agent source. The tools and documents are installed on a Windows PC via a self-extracting installation executable. The NetReady Agent source is made available as a .TAR file. Installations contain documentation and examples.

4.1 NetReady Agent

Any connect CE device can be enabled with the NetReady Agent to support the NetReady suite of services. The Agent is a small, standards-based program that is integrated into an Internet connected device by the CEM. It is written in ANSI C and provided with the SDK as a combination of platform adaptation source code and a private security library. Each of the three main NetReady services can be optionally enabled or disabled at compile time. The Agent is responsible for communicating with the NOC through which it starts SupportTV sessions, detects and downloads firmware updates, and receives provisioned objects. The Agent provides device authentication, error correction, decryption, and image authentication.

The Agent has been ported to dozens of platforms including many variations in CPU type and speed, memory size and speed, middleware, and operating system. The Agent was design to support such platform features as power management, user abort, and dual tuners. To expedite integration, the Agent source code is partitioned into two sections: core and platform adaptation. The core software contains code and data that is common to all implementations of the Agent. This code maintains compatibility with the UpdateLogic Network and should not be modified during integration. The second section is the platform adaptation software. This API is ported by the CEM to a specific platform and contains all the platform-specific code including operating system, memory, socket and openSSL interface, etc. This isolation of core from platform adaptation software simplifies the integration process by insulating the developer from network specifics. To further assist in the integrations, the NetReady Agent provides a number of sample platforms and test applications. Should there be a problem during integration, these variations allow the integrator to isolate issues by eliminating and/or stressing certain features of the Agent.

Complete information regarding the sources and how to port them may be found in the *NetReady Agent Porting Instructions*. The source code is fully commented and is the ultimate reference for a developer.

4.1.1 Modularity

The Agent is designed so that conditional compilation controls which services are enabled in the build. This avoids any extra effort associated with integrating unwanted code and features.

4.1.2 Integration Effort

The Agent typically takes between 4 to 6 man-weeks to integrate and about 2 man-weeks to validate.

4.1.3 Target System Resource Usage

The Agent's system resource requirements are contained in the document titled *NetReady Agent Integration Requirements*.

4.1.4 Agent Build Requirements

The NetReady Agent is distributed as a .TAR file containing both source and private libraries. It is typically unarchived onto a cross-development system. The NetReady Agent source was tested using the following workstation capabilities. We strongly suggest you use comparable hardware.

Linux:

1 GHz Pentium III
256 MB RAM
Linux 2.4 or Linux 2.6 distribution
gcc compiler and associated tools

The Agent source is less than 20 MB. However, the creation of updates can add to this. We suggest a minimum of 10 GB free disk space on your cross-development system to store the Agent Source, examples, and associated updates.

The Agent private libraries are custom built according to each CEM's target tool chain. Please contact UpdateLogic Product Service Engineering if you have any questions about this process.

4.2 NetReady Tools

The NetReady tools are used to define, create, and analyze NetReady updates for use on the Internet, USB, and broadcast transport streams. These tools are Windows XP and Windows 7 compatible. Shortcuts to these tools are installed with the SDK in the "NetReady Tools 3.0.X" program group.

4.2.1 NetReady Publisher

Publisher is a command line tool for the purpose of packaging and encrypting a set of software and data components for distribution as an update. The command line format was chosen to allow it to be easily integrated into the connected device software image make process. The tool imports a software image and exports a .CAB file containing compatibility information and encrypted module data. The .CAB file is made up of transport modules which are used to transmit updates..

Please see the *NetReady Publisher* document for more information.

4.2.2 NetReady Tools Installation

The NetReady Tools are installed onto a Windows XP or Windows 7 PC where they are enabled for defining, building, and viewing updates. You must have at least version 2.0 of the Microsoft .NET Framework installed on the PC that you use the tools on. Please see www.microsoft.com downloading instructions of the .NET Framework.

The NetReady Tools are tested using the following workstation capabilities. We strongly suggest you use comparable hardware.

Microsoft Windows:
2 GHz Pentium
1 GB RAM
Windows XP or Windows 7 OS

The initial installation of the tools requires less than 50 MB of free disk space, however, the creation of transport streams will quickly add to this. Therefore, the disk storage requirements will vary based on the number and size of the carousels, test data, and transport streams you

generate. We suggest a minimum of 10 GB free disk space on your Windows development system to store the tools, examples, and associated transport streams.

5   The UpdateLogic Network

5.1 The UpdateLogic NOC

The UpdateLogic Network Operations Center ("NOC") is a set of servers in the cloud that control all electronic data communications throughout the UpdateLogic network. Even though all physical nodes of the UpdateLogic network are on the Internet, communications between nodes are all managed by the NOC. The NOC has a web interface that is used by CEM engineers, UpdateLogic personnel, the SDK tools, and the UpdateTV Broadcast servers. Use of the UpdateLogic NOC is described in the document *UpdateLogic Network Operation Center Users Guide*.

5.2 Network Security

There are multiple areas of security in the UpdateLogic network. The three primary areas are the Internet based NOC communications, SecureTV object encryption, and update data encryption. All NOC communications use SSL.   Update data is secured by symmetric key encryption where the key is protected by asymmetric encryption or hardware. Data is encrypted by the Publisher tool and transmitted in its encrypted, tamper-proof form over the Internet, through the UpdateLogic broadcast network, or via USB until reaching the target device where it is authenticated and decrypted for use. CEM-specific encryption keys are provided to the manufacturer as part of the integration process. Encryption and authentication is necessary to protect the image during the various stages of the delivery process.   For more information on this topic please see the *NetReady Network Security* document.

5.3 Terrestrial and Cable Network

Through an exclusive relationship with the Public Broadcasting Service (PBS), UpdateLogic operates a nationwide network of broadcast servers that can transmit software updates over-the-air (OTA), also known as over-the-air download (OAD), utilizing existing digital terrestrial broadcast bandwidth in the United States. Any device with an ATSC antenna such as a television set, mobile handheld device, or a digital sign can access this data.

UpdateLogic maintains relationships with US-based cable operators such as Comcast, Time Warner, Cox, and Charter and through a contract with CableLabs, UpdateLogic can transmit software updates across cable networks directly to devices and automatically install without consumer intervention.

The broadcast network consists of roughly 100 broadcast encoder montitors ("BEMs") that generate data streams which are then multiplexed with digital video program content at a broadcast facility. The carousel data is periodically downloaded from the UpdateLogic NOC to the BEMs. The BEMs compile this information into a continuous DSM-CC serial bit stream which includes both signaling data and module data on a single PID. This protocol is defined by the ATSC A/90 and ATSC A/97 standards.