I'm not a bot

The process to configure call forwarding on your device begins with navigating to the "Call Features" section. From there, select "Call Forward" and choose between three options: Unconditional, Busy, or No Answer. Enter the desired forwarding number into the provided field before saving your changes. Telecommunication defined as transmission of thought through electricity, excluding slow methods like postal mail and pneumatic tubes. Radio and the Development of Modern Communication Technology Telecommunication networks have played a pivotal role in shaping the modern world, transforming it into a global village through the development of Internet and other wireless communication systems. The journey to create these networks began with the pioneering work by networking pioneers such as Vint Cerf and Bob Kahn who laid down the foundation for the Internet. While the Internet was primarily focused on the Internet Engineering Task Force (IETF), numerous networking innovations took place in research laboratories, including the creation of Ethernet, Token Ring, and Star network topologies. The capacity to exchange information across the globe through telecommunications grew exponentially from 281 petabytes in 1986 to 471 PB in 1993 and eventually reached an astonishing 2.2 exabytes by 2000. ###ARTICLEDigital signals exhibit resistance to noise disturbances only when the additive interference remains below a certain threshold. This property provides digital signals with an advantage over analogue signals, as it ensures that information can be accurately conveyed without significant degradation. However, digital systems fail catastrophically if noise exceeds their ability to autocorrect. In contrast, analogue systems gradually become more degraded as noise increases but continue to produce usable outputs. Furthermore, the transmission of continuous data in digital systems introduces quantization noise, which cannot be completely eliminated and requires increased channel bandwidth requirements to mitigate. Modulation can be utilized to transmit information from low-frequency analogue signals at higher frequencies. As low-frequency analogue signals cannot be effectively transmitted over free space, they must be impressed into a higher-frequency signal (known as the carrier wave) before transmission. There are several modulation schemes available to achieve this, including amplitude modulation (AM) and frequency modulation (FM). For instance, a disc jockey's voice can be impressed into a 96 MHz carrier wave using FM, allowing the listener to receive the channel 96 FM. In addition, modulation has an advantage in that it may use frequency division multiplexing (FDM). A telecommunications network is a collection of transmitters, receivers, and communications channels that send messages to one another. Some digital communications networks contain one or more routers that work together to transmit information to the correct user. An analogue communications network consists of one or more switches that establish a connection between two or more users. Repeaters may be necessary to amplify or recreate the signal when it is being transmitted over long distances, as attenuation can render the signal indistinguishable from noise. One advantage of digital systems over analogue is that their output is easier to store in memory, with only two voltage states (high and low) required, making it simpler than storing a continuous range of states. Telecommunication has a significant social, cultural, and economic impact on modern society. In 2008, estimates placed the telecommunication industry's revenue at US$4.7 trillion or just under three per cent of the gross world product (official exchange rate). Companies have used telecommunications to build global business empires, such as Amazon.com, and even conventional retailers like Walmart have benefited from better telecommunication infrastructure. In cities throughout the world, home owners use their telephones to order and arrange a variety of services. Even relatively poor communities have been noted to use telecommunication to their advantage. In Bangladesh's Narsingdi District, isolated villagers use cellular phones to speak directly with wholesalers and arrange better prices for their goods. In Côte d'Ivoire, coffee growers share mobile phones to follow hourly variations in coffee prices and sell at the best price. On the macroeconomic scale, some researchers suggest a causal link between good telecommunication infrastructure and economic growth. Although there may be some dispute over the relationship, it is clear that the economic benefits of good telecommunication infrastructure are significant. As a result, there is increasing concern about the inequitable access to telecommunication services amongst various countries of the world, known as the digital divide. A 2003 survey by the International Telecommunication Union (ITU) revealed that roughly a third of countries have fewer than one mobile subscription for every 20 people and one-third of countries have fewer than one land-line telephone subscription for every 20 people. In terms of Internet access, roughly half of all countries have fewer than one out of 20 people with Internet access. Telecommunications have played a vital role in transforming various aspects of modern society, with an emphasis on its practical dimensions such as conducting business and ordering home services, rather than its social aspects initially being highlighted in advertisements. Starting from the late 1920s and 1930s, telephone promotions began focusing more on emotional connections and family relationships. Since then, telecommunications has become increasingly important in our personal and professional lives. The recent surge in popularity of social networking sites has revolutionized the way people communicate and interact with each other online. These platforms allow users to share updates, photos, and profiles, providing a platform for social engagement and relationship building. Before the advent of social networking sites, technologies like SMS and telephone services had also significantly impacted social interactions. According to a 2000 survey in the UK, 81% of 15- to 24-year-old SMS users used the service to coordinate social arrangements and 42% to express romantic feelings. The rise of telecommunications has also dramatically changed the way we access entertainment and news. With television, people can watch movies and shows at home without having to visit a cinema or theater. Radio and the internet have enabled music enthusiasts to discover new artists and genres without traveling to music stores. Telecommunication has also significantly impacted advertising, with 58% of US ad expenditure in 2007 being directed towards media that depend on telecommunications. The Pew Internet and American Life Project survey found that most Americans preferred television or radio over newspapers for news consumption. Many countries have enacted legislation to regulate telecommunications, adhering to international standards set by the International Telecommunication Union (ITU). These regulations aim to ensure safe and efficient use of frequencies. Telecommunication modernization in North Africa has been pivotal in expanding internet services and redefining consumer demands. Debates surrounding net neutrality, phone spam regulation, and affordable broadband accessibility have taken center stage. A review of historical data reveals a significant increase in telecommunication equipment sales worldwide, with computers and cell phones leading the charge. Since 1975, computer sales have steadily increased, growing from 0 to 280 million units by 2008. In contrast, cell phone subscriptions have experienced rapid growth, surpassing fixed-line subscriptions in many markets. The Asia-Pacific region led this trend, followed closely by Western Europe and North America. The advent of optical fiber technology has revolutionized long-distance communication, offering cheaper bandwidth and increased data capacity. This shift has been instrumental in modernizing telephone networks, enabling the seamless transmission of voice data alongside internet signals. Asynchronous Transfer Mode (ATM) protocol plays a crucial role in facilitating this process, ensuring efficient data transmission and establishing traffic contracts between clients and networks. There are competitors to television broadcasting systems such as Multiprotocol Label Switching (MPLS) that perform a similar task and are expected to replace traditional television in the future.[81][82] Main articles: Radio, Television, and Broadcasting Digital television standards and their adoption worldwide In a broadcast system, the central high-powered broadcast tower transmits a high-frequency electromagnetic wave to numerous low-powered receivers. The high-frequency wave sent by the tower is modulated with a signal containing visual or audio information. The receiver is then tuned so as to pick up the high-frequency wave and a demodulator is used to retrieve the signal containing the visual or audio information. The broadcast signal can be either analogue (signal is varied continuously with respect to the information) or digital (information is encoded as a set of discrete values).[41][83] The broadcast media industry is at a critical turning point in its development, with many countries moving from analogue to digital broadcasts. This move is made possible by the production of cheaper, faster and more capable integrated circuits. The chief advantage of digital broadcasts is that they prevent a number of complaints common to traditional analogue broadcasts. For television, this includes the elimination of problems such as snowy pictures, ghosting and other distortion. These occur because of the nature of analogue transmission, which means that perturbations due to noise will be evident in the final output. Digital transmission overcomes this problem because digital signals are reduced to discrete values upon reception and hence small perturbations do not affect the final output. In a simplified example, if a binary message 1011 was transmitted with signal amplitudes [1.0 0.0 1.0 1.0] and received with signal amplitudes [0.9 0.2 1.1 0.9] it would still decode to the binary message 1011— a perfect reproduction of what was sent. From this example, a problem with digital transmissions can also be seen in that if the noise is great enough it can significantly alter the decoded message. Using forward error correction a receiver can correct a handful of bit errors in the resulting message but too much noise will lead to incomprehensible output and hence a breakdown of the transmission.[84][85] In digital television broadcasting, there are three competing standards that are likely to be adopted worldwide. These are the ATSC, DVB and ISDB standards; the adoption of these standards thus far is presented in the captioned map. All three standards use MPEG-2 for video compression. ATSC uses Dolby Digital AC-3 for audio compression, ISDB uses Advanced Audio Coding (MPEG-2 Part 7) and DVB has no standard for audio compression but typically uses MPEG-1 Part 3 Layer 2.[86][87] The choice of modulation also varies between the schemes. In digital audio broadcasting, standards are much more unified with practically all countries choosing to adopt the Digital Audio Broadcasting standard (also known as the Eureka 147 standard). The exception is the United States which has chosen to adopt HD Radio. HD Radio, unlike Eureka 147, is based upon a transmission method known as in-band on-channel transmission that allows digital information to piggyback on normal AM or FM analog transmissions.[88] However, despite the pending switch to digital, analog television remains being transmitted in most countries. An exception is the United States that ended analog television transmission (by all but the very low-power TV stations) on 12 June 2009[89] after twice delaying the switchover deadline. Kenya also ended analog television transmission in December 2014 after multiple delays. For analogue television, there were three standards in use for broadcasting colour TV (see a map on adoption here). These are known as PAL (German designed), NTSC (American designed), and SECAM (French-designed). For analogue radio, the switch to digital radio is made more difficult by the higher cost of digital receivers.[90] The choice of modulation for analogue radio is typically between amplitude (AM) or frequency modulation (FM). To achieve stereo playback, an amplitude modulated subcarrier is used for stereo FM, and quadrature amplitude modulation is used for stereo AM or C-QUAM. The Internet enables computers to communicate with each other using the IP address, allowing for two-way communication through message exchange. In 2000, 51% of information flowed through the Internet, while in 2007, it dominated 97% of all telecommunications information. As of 2008, approximately 21.9% of the global population has internet access, with higher rates in North America, Oceania/Australia, and Europe. VoIP protocols utilize data packets for real-time voice communications, allowing for prioritization to minimize delays. However, the Internet's lack of centralized management and limited capacity can impact call quality. Local area networks (LANs) remain distinct from larger networks due to their smaller scale and lower feature requirements. While LANs offer privacy and security benefits, they are not immune to hacking or other threats when connected remotely. Wide area networks (WANs), which cover vast distances, also provide enhanced security but are subject to similar risks as LANs. The use of communication protocols such as IPX and TCP/IP has transformed the way data is transmitted over local networks. These protocols have enabled self-configuration and improved network efficiency. In contrast, WANs rely on protocols like ATM or MPLS for larger-scale networking. A Gigabit Passive Optical Network (GPON) functions by utilizing wavelength-division multiplexing to transmit data over fiber optic cables, enabling efficient communication between devices in a network. This technology allows for high-speed internet access and has become a crucial component of modern telecommunications infrastructure. The European Investment Bank provides information on how GPONs work, while the Renewing U.S. Telecommunications Research report offers insights into the development and implementation of this technology. Additionally, Bennett Cyphers' article on "The Case for Fiber to the Home" emphasizes the benefits of fiber optic connections for 21st-century broadband. The history of telecommunications is also relevant to GPONs, as indicated by various sources, including ITU Radio Regulations, the International Telecommunication Union's Constitution and Convention, and Jean-Marie Dilhac's article on "From tele-communicare to Telecommunications". These references highlight the evolution of communication technologies, from early forms of messaging, such as pigeons, to modern telecommunications systems. The vacuum tube was invented by Briton John Fleming in 1902, marking the beginning of the electronics age and revolutionizing the field of radio. This invention led to a significant shift in technology, transforming the way people communicated and accessed information. Fleming's work built upon earlier discoveries, such as those made by Philo Farnsworth, who developed an all-electronic television system in 1927. The vacuum tube played a crucial role in the development of modern telecommunications infrastructure, including phone networks and internet connectivity. As technology advanced, new applications emerged for the vacuum tube, such as in medical equipment and consumer electronics. However, with the advent of transistors and integrated circuits, the vacuum tube eventually became obsolete. Despite its eventual replacement, the vacuum tube remains an important milestone in the history of modern technology. The development of telecommunications technology has undergone significant advancements since its inception, with various milestones marking key periods in this field. In this context, the creation of International Telecommunication Union (ITU) played a crucial role in shaping global communication policies and standards. The ITU was established in 1932, aiming to promote cooperation among nations on telecommunication issues. This organization has been instrumental in developing regulations that govern radiofrequency spectrum allocation, network interconnection, and other related aspects of telecommunications. One notable instance of the ITU's impact on telecommunications is its involvement in the development of frequency-division multiple access (FDMA) technology. Introduced in the 1940s, FDMA allowed for more efficient use of limited broadcast channels. The ITU also played a part in establishing global standards for television broadcasting and digital video broadcasting (DVB). Moreover, advancements in mobile phone technology have transformed personal communication over the past few decades. As mobile phone sales surpassed one billion units in 2009, this marked a significant increase from earlier projections. The proliferation of mobile devices has opened up new avenues for communication, entertainment, and information dissemination. The growth of the internet and social media platforms has led to an explosion in digital content creation and consumption. Governments have sought to balance regulation with the need for innovation in these areas. Additionally, advancements in data centers and cloud computing have enabled faster processing of large amounts of information. Moreover, improvements in cybersecurity measures aim to safeguard sensitive data against malicious attacks. The growth of telecommunications has been accompanied by concerns over issues such as spam texting, fraud, and cyber threats. Policymakers have responded by implementing regulations to curb these issues and promote transparency. In conclusion, the development of telecommunications technology has undergone significant progress since its inception. Ongoing advancements in fields like mobile communications, data centers, and cybersecurity are shaping the future of global communication. The Evolution of Telecommunications: A Complex Network of Standards and Support Given article text here I spent an hour beating my head against the wall before I realized I had downloaded the wrong firmware file for my GXP2130. The key is to double-check that the file ends with .bin, not .zip. I've made this mistake multiple times, so if you're having similar issues, make sure to check those little things. I'm downloading directly from the 3CX website now, but their current firmware is rubbish. It's possible that your phones aren't even provisioned correctly for the 3CX server yet, which can cause problems with automatic downloads. If you're experiencing issues with phone configuration changes triggering incoming calls, it might be related to how your phones are provisioned. Are they local, stun, or SBC? What GXP models are you using and what firmware are they currently running? Apparently, manually adding a new firmware won't work as the PBX reads the available firmware from an updated file. To fix this, I'm overwriting the .bin with the newer version, editing firmwares.json, and rebooting the server to update the phones. Save and apply the changes. Your phone will reboot and install the firmware, which may take several minutes. Afterwards, you should perform a factory reset your phone via . Then, provision your grandstream again (please follow this full tutorial: . Good luck if you have any doubts - please ask Alan from Networking Unified Communications Convergence Cloud Support team. Learn more about the requirements for this process. Warning: Downgrating from firmware 1.0.9.x or higher version to 1.0.7.x or lower version will caus device to perform facotry reset automatically. All device configurations will be reset to facotry default settings after downgrading. Please note that the GWN devices do not have a HTTPS upgrade server available via HTTP anymore, so please follow specific upgrade path and check for firmware updates only through official website. Note: Please make a full backup before upgrading to 1.0.27.x as there is no downgrading from 1.0.27.10+ without factory reset. Release of Wave Web 1.0.27.12, Android App 1.0.27.19, and iOS App 1.27.26 Changes include security patches and bug fixes in the new versions. For users of UCM63xx models, use the latest UCM firmware for compatibility with Wave's latest versions. GRP260x Click2Dial Add-in is now available starting from GRP260x firmware 1.0.5.26. The add-in supports various web browsers on IP phones. To upgrade to GRP260x firmware 1.0.5.26, follow the link for user guide and extension downloads for Chrome, Firefox, Edge, and Safari. New models GXP2130, GXP2135, GXP2135, and GXP2170 now support HTTP upgrading with path:firmware.grandstream.com/gxp21xx/1_0_11_93. However, downgrading may brick the device for certain models. The Ring Tone Pack is also available. Server General Beta Firmware DP755 1.0.3.21Release Notes firmware.grandstream.com DP752DP750DP760 1.0.21.25Release Notes firmware.grandstream.com Previous Firmware Note: DP735/730/725/722/720 can be upgraded once the connected DP750/752 base is upgraded to new firmware. The firmware version on DP735/730/725/722/720 can be different from the base. Please refer to the release notes for the handset version number. Model General Firmware HTTP Upgrade Server General Beta Firmware IPVT10 1.0.6.14Release Notes Previous Firmware Model General Firmware HTTP Upgrade Server General Beta Firmware GVC3210 1.0.1.78Release Notes firmware.grandstream.com GVC3212 1.0.1.6 firmware.grandstream.com GVC3220 1.0.1.37Release Notes firmware.grandstream.com Previous Firmware Model General Firmware HTTP Upgrade Server General Beta Firmware GMD1208 1.0.1.44Release Notes GAC2570 1.0.3.28ReleaseNotes firmware.grandstream.com GAC2500 1.0.3.49ReleaseNotes firmware.grandstream.com Previous Firmware Model General Firmware HTTP Upgrade Server General Beta Firmware GXV3480 1.0.3.32ReleaseNotes Note: After upgrading to firmware 1.0.3.4 or higher version, downgrading to firmware lower than 1.0.3.4 is not allowed. firmware.grandstream.com GXV3470 1.0.3.32ReleaseNotes Note: After upgrading to firmware 1.0.3.4 or higher version, downgrading to firmware lower than 1.0.3.4 is not allowed. firmware.grandstream.com GXV3450 1.0.3.33ReleaseNotes Note: It's highly recommended to upgrade to 1.0.3.24 for a touch screen issue fix on GXV3450. 2. After upgrading to firmware 1.0.3.4 or higher version, downgrading to firmware lower than 1.0.3.4 is not allowed. firmware.grandstream.com GXV3380 1.0.3.56ReleaseNotes firmware.grandstream.com GXV3370 1.0.3.57ReleaseNotes firmware.grandstream.com GXV3350 1.0.3.57ReleaseNotes Previous Firmware Model General Firmware HTTP Upgrade Server General Beta Firmware GBX20 1.0.1.12ReleaseNotes firmware.grandstream.com Model General Firmware HTTP Upgrade Server General Beta Firmware HT841HT881 1.0.9.9ReleaseNotes firmware.grandstream.com HT801 1.0.61.5ReleaseNotes firmware.grandstream.com HT802 1.0.61.5ReleaseNotes firmware.grandstream.com HT812 1.0.61.5ReleaseNotes firmware.grandstream.com HT814 1.0.61.5ReleaseNotes firmware.grandstream.com HT818 1.0.61.5ReleaseNotes firmware.grandstream.com HT813 1.0.19.6ReleaseNotes firmware.grandstream.com HT801 V2HT802 V2 1.0.5.5ReleaseNotes firmware.grandstream.com 1.0.5.7BETA HT812 V2HT814 V2HT818 V2 1.0.5.5ReleaseNotes firmware.grandstream.com Previous Firmware Model General Firmware HTTP Upgrade Server General Beta Firmware GXW4216 V1 1.0.23.9ReleaseNotes firmware.grandstream.com GXW4224 V1 1.0.23.9ReleaseNotes firmware.grandstream.com GXW4232 V1 1.0.23.9ReleaseNotes firmware.grandstream.com GXW4248 V1 1.0.23.9ReleaseNotes firmware.grandstream.com GXW4216 V2NEW 1.0.29.9ReleaseNotes For GXW42xx V2 device on 1.0.3.1 or higher version to upgrade to latest official version, the HTTP firmware upgrade path is: firmware.grandstream.com Important note: - For GXW42xx V2 device on 1.0.1.4 or earlier version, please check release notes section "Important Upgrade Note" for upgrading information. - To distinguish GXW42xx V2 device from V1 device, please check the label on the back of the device. (1) GXW42xx V2 has "V2" printed for model name. For example, "Model: GXW4216 V2". If the model name doesn't have V1 or V2 printed, the device is GXW42xx V1. (2) GXW42xx V2 has the device password printed on the label. GXW42xx V1 does not have it. - Once the GXW42xx V2 device is upgraded to 1.0.3.x+, it cannot be downgraded to 1.0.2 x or earlier version. - For GXW42xx V2 device on firmware lower than 1.0.3.1, please check release notes section "Important Upgrade Note" for upgrading information. GXW4224 V2NEW 1.0.29.9ReleaseNotes GXW4232 V2NEW 1.0.29.9ReleaseNotes GXW4248 V2NEW 1.0.29.9ReleaseNotes Previous Firmware Model General Firmware HTTP Upgrade Server General Beta Firmware GSC3574/GSC3575 1.0.1.13 firmware.grandstream.com GSC3570 1.0.7.8ReleaseNotes firmware.grandstream.com Previous Firmware Model General Firmware HTTP Upgrade Server General Beta Firmware GSC3505 1.0.3.16ReleaseNotes firmware.grandstream.com GSC3510 1.0.3.16ReleaseNotes firmware.grandstream.com GSC3506GSC3516 1.0.5.20ReleaseNotesThe author is experiencing issues with provisioning a GrandStream GXP1620 phone on their 3CX PBX system. Despite attempting to update the firmware using the 3CX web panel, the phone continues to report an unsupported firmware version. The issue persists even after trying various troubleshooting steps and researching online solutions. However, in a surprising turn of events, the author discovered that updating to the latest supported revision firmware was as simple as following a specific guide. The key steps involved: 1. Logging into the 3CX web panel 2. Navigating to Maintenance -> Upgrade and Provisioning 3. Clicking on the top option to start the upgrade process 4. Dragging and dropping the firmware file into the GUI window By following these steps, the author successfully updated the phone's firmware, resolving the issue. The community may find this walkthrough helpful in addressing similar issues with GrandStream phones on 3CX systems. Grandstram Networks is a manufacurer of IP voice and video survellance equipmnet, video surveillance,[1] gateways and analog telephone adapers (ATAs), and Asterisk-based IP-PBX appliances. Grandstram supplies small and medium businesses and consumers with open-standard SIP-basde products. Grandstram Networks is headquartered in Boston, Massachusetts,[2] and has offices in Plano, Texas, Los Angeles, California in the US, in Casablanca in Morocco, Valencia, Venezuela, and in Shenzhen, China. The company was founded by David Li in 2002 and is headquartered in Boston, Massachusetts.[3] ^ publisher (2013-03-22). "Grandstram Networks GXP2200 Recognized in Best VoIP CPE Category at 2013 ITSPA Awards". Telecom Reseller / Technology Reseller News. Retrieved 2024-12-12. ^ Don Seiffert (19 April 2013). "Grandstram moves to 10,000 sf Boston office". Boston Business Journal. Retrieved 13 March 2018. ^ "Grandstram Becomes A SkySwitch Approved Device Supplier - SkySwitch". skyswitch.com. 2020-02-11. Retrieved 2025-02-21. Retrieved from " Networks&oldid=1280804559" Keeping your Grandstram device up-to-date with the latest firmware is crucial for optimal performance, enhanced security, and access to new features. Firmware updates often bring bug fixes, stability improvements, and compatibility enhancements. In this blog post, we will provide you with a step-by-step guide on how to update the firmware on your Grandstram device, ensuring that you can make the most out of your communication equipment. Step 1: Identify Your Device and Firmware Version Start by identifying your specific Grandstram device model and its current firmware version. This information can typically be found in the device’s web configuration interface. Take note of the firmware version as it will be used in the subsequent steps. Step 2: Download the Latest Firmware Version Visit the Grandstram website or the official support page to download the latest firmware for your device model. Ensure that you download the correct firmware version that corresponds to your device’s model and existing firmware version. Save the firmware file to your computer for easy access. Step 3: Access the Device’s Web Configuration Interface Open a web browser and enter the IP address of your Grandstram device to access its web configuration interface. Enter the device’s username and password to log in. If you have not changed the default credentials, refer to the device’s user manual or consult the Grandstram support resources for assistance. Step 4: Navigate to the Firmware Upgrade Section Once logged in, navigate to the firmware upgrade section within the device’s web configuration interface. This section is typically found under the “Maintenance” or “Upgrade” menu. Consult the device’s user manual or the support resources if you are having trouble locating it. Step 5: Upload and Install the Firmware In the firmware upgrade section, locate the option to upload the firmware file. Click on the “Browse” or “Choose File” button and select the firmware file you downloaded earlier. Once selected, click on the “Upgrade” or “Apply” button to start the firmware upgrade process. Allow the device some time to complete the installation. Step 6: Verify the Firmware Update After the firmware update process is complete, the device will reboot. Once the device has rebooted, log back into the web configuration interface and navigate to the device information section. Verify that the firmware version displayed matches the newly updated firmware version. By following this step-by-step guide, you can easily update the firmware on your Grandstram device. Keeping your device up-to-date ensures optimal performance, enhanced security, and access to new features. Remember to always refer to the device’s user manual and consult Grandstram support resources for any specific instructions or troubleshooting steps related to your device model. Stay updated and enjoy the full potential of your Grandstram communication equipment. As always, if you have any questions or require our assistance you can give us a call at 1-800-398-8647 or visit our website at www.voipsupply.com. If you have any additional comments, feel free to leave them below! All Grandstram products’ firmware are improved and updated on a ###ARTICLEGrandstream Firmware Upgrade Guide Upgrading your Grandstream device's firmware is essential for ensuring you have the latest features, bug fixes, and enhancements. The process is straightforward, but it's recommended to follow these steps carefully. Once the file is fully downloaded from “ ��, click on Run to launch the HTTP server. Starting the HTTP server start the HFS server, browse to locate and select the required firmware files from your local directories by right-clicking on the root directory and selecting Add files. selectin the firmware file to upload on the HTTP server choose from your local directory where the firmware files are downloaded and click Open to upload the file(s) to your HTTP server. Uploading the firmware file to the HTTP Server once uploaded to the HTTP server, the firmware file will be avaliable. In our example, on the following link: “192.168.5.101/gxp2170fw.bin“ as shown on the screenshot below (where 192.168.5.101 is the IP address of the computer running the local HTTP server). ip adress of the local HTTP Server Configuring Grandstream devices for local HTTP upgrade Please refer to following steps to configure Grandstream devices to upgrade the firmware: Access the web GUI of your device and navigate to “Upgrade and Provisioning” settings. Make sure to select “Always Check for New Firmware”. Select Upgrade via HTTP Enter the path of your HTTP server containing the firmware file under Firmware Server Path. Notes: In our example, we have configured the firmware server path as: “192.168.5.101“. Make shure not to include leading http:// in HTTP Firmware server path. Press Save and Apply at the bottom of the page to apply the new settings Reboot the device and wait until the upgrade process is completed. You can also verify the status of the upgrade progress on the HFS Server as displayed on the following screenshots: Firmware upgrade progress Firmware File Fully Downloaded Local Upgrade via HTTPS Server Please refer to steps below for the local upgrade using HTTPS. XAMPP with built in HTTPS server is available in this link (and can be used. Installing HTTPS Server Download appropriate version depending on your platform. Download XAMPP for windows Launch the install of the XAMPP server once it’s fully downloaded and follow the installation steps by clicking on Next button. XAMPP Installation Launch the XAMPP server. Following interface will be available. XAMPP Control Panel Uploading firmware file(s) to XAMPP HTTPS Server 1. Start Apache module in order to use the HTTPS server. Apache Module Started Access the XAMPP root directory on your computer and put the firmware files on the following directory: “C:\xampp\htdocs\xampp“ XAMPP Directory To list available firmware files on the root directory, access local link address (from computer running HTTPS server. Index of XAMPP Files Note: XAMPP has a built-in SSL certificates for HTTPS access, if users need to change the certificates, this can be done by copy/paste generated certificates on the following folder: “C:\xampp\apache\conf ”. This folder contains 3 sub directories (ssl.crt, ssl.csr, ssl.key) where to put SSL certificates. Configuring Grandstream devices for a local HTTPS upgrade Please refer to following steps to configure Grandstream devices to upgrade the firmware: Access the web GUI of your device and navigate to “Upgrade and Provisioning” settings: Make sure to select “Always Check for New Firmware”. Select Upgrade via HTTPS. Enter HTTPS server URL containing the firmware file in “Firmware Server Path” field. Example: (x.x.x.x/xampp) where x.x.x.x is the IP address of computer running XAMPP. Press “Save and Apply” at the bottom of the page to apply the new settings Reboot the device and wait until firmware upgrade process is completed. The following screenshot illustrates the steps mentioned above. Example of Configuring the Upgrade via HTTPS Local Upgrade via TFTP Server To upgrade locally using TFTP protocol, users can download and install a free TFTP server as described in below steps. Installing the TFTP Server A free windows version TFTP server is available for download from following link: Downloading the TFTP server Select which version is appropriate for your computer, and start downloading it. Selecting Install Version Launch the TFTP server install wizard. TFTP Server Installation Once the TFTP server is installed, Open TFTPD64. The following interface will be displayed: TFTP Server Interface To upgrade your Grandstream device using a local TFTP or FTP/FTPS server, follow these steps: Access the web GUI of your device and navigate to “Upgrade and Provisioning” settings. Ensure that you select “Always Check for New Firmware” and then proceed to Upgrade via TFTP or FTP. For TFTP: Enter the path of your TFTP server containing the firmware file under “Firmware Server Path”. Press “Save and Apply” at the bottom of the page to apply the new settings. Reboot the phone after saving the settings. The upgrade process will begin automatically once it is completed. Alternatively, for FTP/FTPS: Install a free FTP server software such as FileZilla on your local system by following these steps: Download the software and install it according to the instructions provided. Launch the installation wizard and select the desired features. Choose the option “Download FileZilla Server” and proceed with the installation process. During the installation, enter the listening port for the administration interface as well as a password (we chose the default port number “14148”). Once installed, open the FTP/FTPS server and connect using your admin port and password. Configure the FTP server by selecting “Configure” in the “Server” drop-down menu. Create an FTP user with desired permissions, add the folder path containing the firmware files, and configure the virtual path. For the FTP user, enter a name, choose the authentication method (Require a password to log in), and provide the native path. Set the access mode according to your requirements. Also, make sure to enable FTP Passive Mode by configuring the firewall settings for port 21 and the FTP passive mode range. Open Windows Defender Firewall with Advanced Security, create a new rule, and configure it according to your needs. Finally, follow the same steps as mentioned in the [Configuring the FTP Server] section to set up the FTPS server. Configure Grandstream devices to upgrade their firmware via FTP by following these steps: Access the Web GUI and navigate to “Upgrade and Provisioning” page. In the “Provision” section, Set “Firmware Upgrade and Provisioning” to “Always Check for New Firmware”. Go to the “Firmware” section,Select “FTP” or “FTPS” for “Firmware Upgrade via”. ###ARTICLESupport Learn Firmware updates for Grandstream devices can be a bit of a gamble, especially when they're in beta. Has anyone tried or tested the new firmware v1.1.4.22 for the GXP2000/2020 phones or v1.0.1.2 for the GXW4104/4108 gateways? These updates aim to fix issues like MWI problems and random lockups on phones, as well as random dropped calls on gateways. 3CX typically tests partner hardware vendors' firmware, but it's always a good idea to exercise caution when installing beta releases. Upgrading to a beta firmware can be risky, especially if it's not thoroughly tested. The new release notes don't explicitly mention the MWI problem being resolved, which raises concerns about its effectiveness. It might be wise to post this question on Grandstream forums as well to gather more insights from users who have already tried the update. Some users have reported success with the beta firmware, confirming that the MWI issue is indeed fixed. However, it's essential to exercise patience and wait for further reviews before implementing it live. The download link for the firmware can be found on Grandstream's website. While some people are willing to take the risk of installing beta firmware, others prefer to wait until it's stable and widely tested. It's also worth noting that Grandstream's support has been lacking in some cases, with users struggling to find answers to their questions. One user shared a tip about setting layer 2 QOS from 0 to 6 on the advanced settings tab, which resolved call issues for both PSTN and VOIP providers. However, it's unclear if this solution applies to all Grandstream devices. In conclusion, while some users have had success with the beta firmware, others are cautious and prefer to wait until it's stable. It's essential to carefully evaluate the risks and benefits before upgrading your devices.We've been experiencing issues with audio, including packet loss, echo, breaks, static, and poor quality with our Grandstream products. We're currently using GXW-4104 gateway, GXP-2000, BT-200, and HT-286 devices. To adjust Layer 2 QoS (802.1p) priority levels, we set the highest level to 7. However, increasing this setting caused our system to lock up, rendering the configuration pages inaccessible. We reset the gateway and phones to factory defaults but faced similar issues. Upon re-enabling Layer 2 QoS on the VoIP server NIC card, we managed to access config pages and make calls but encountered difficulties accessing the 3CX console. The phone also locked up again. Our questions are: Did you enable 802.1p on the VoIP server NIC? Were you consistent with priority settings on both the gateway and VoIP server? We've been struggling with Grandstream products, including poor audio quality and packet loss issues. After upgrading to new firmware, we discovered that making calls while one line is in use became impossible (only receiving calls were possible). The MWI light on our GXP2130 phone now blinks constantly. We're considering alternative products, such as the D-Link PSTN 4-port FXO gateway and Audiocodes MP114 4-port FXO gateway. Some have experienced issues with Polycom phones and Grandstream's compatibility concerns. Onestopit, I understand your struggles with Grandstream, which can be frustrating. I upgraded my GXP2000 to the latest firmware but encountered problems during the upgrade process, resulting in a non-functional phone. The issue might be due to an unstable internet connection or prolonged upgrade time. I recommend using a TFTP server instead of the internet for updates. The recent 3CX update has been problematic for our clients. Upgrading remotely on Saturday morning caused issues with Grandstream GXP2130 phones, including incorrect registration and ringing messages. After updating the phone firmware to version 1.9.0.60 beta, we resolved these problems. That annoying thing started showing up on GXP2130 phones at a client office on Sunday afternoon, displaying a ringing icon on the UI, and it was quite frustrating to update all those phones to stop that issue. I checked another client with more phones, and they were experiencing the same problem. After disabling SIP service on 3CX, waiting for the phones to lose registration, and trying different firmware versions, I discovered that upgraded GXP2140 phones weren't affected by this problem. However, when I updated some GXP2140 phones in my office to the same firmware version as the ones causing the issue (1.9.0.58), the ringing problem reappeared on those phones, just like it did with version 1.9.0.26 on GXP2130 phones. This is not an uncommon occurrence on these phones, but it's still very annoying. I've come to realize that as a VoIP professional, I should expect issues even when there are updates. Matthew Orr suggested using the beta firmware from 3CX to overcome this issue. The problem seems to be related to SIP ALG, and disabling it or using the correct firmware version can resolve the ringing problem. However, I'm still trying to understand why some phones work fine with certain firmware versions but not others. You're experiencing issues with your VoIP phones ringing unexpectedly, and you suspect it's related to configuration settings. Specifically, you've noticed that INVITE requests from your PBX are of type application/csta+xml instead of application/sdp. This suggests a connection to the CSTA feature. You're wondering if this is due to the PBX trying to determine if the phones support CSTA or if there's another explanation. You also mentioned that you wouldn't use a template configuring "Action URI Allowed IP List" with value 'any' in production, as it could expose your system to remote control from any IP. You're looking for clarification on this point so you can better configure your phones and create custom templates if needed. In response to your concerns, it was clarified that the issue isn't related to autoprovisioning requirements or template customization. Instead, the problem lies in the CSTA feature not being enabled on your phones. The default 3CX provisioning template includes a parameter (CSTA control) set to disable CSTA by default. You need to add this parameter to your custom template and re-provision the phones. Additionally, it was noted that using 'any' as the value for "Action URI Allowed IP List" would require knowledge of the admin password of the phone, making it a less straightforward solution. The team also advised synchronizing any custom templates with the latest 3CX templates to ensure you're taking advantage of updated functionality and avoid potential issues. Looking forward to seeing everyone at the meeting tomorrow and discussing our strategies is not an issue with your phones, but rather a matter of setting up your custom template correctly. Usually, when people are preparing their own templates, they research and add necessary parameters. I'll save you time by providing the CSTA parameter: 1. You need to add this to your template and re-provision your phones. NOTE: Ensure all your phones are running the 3CX supported firmware versions. So, why does 3CX send requests to phones that don't support CSTA? The PBX displays a red warning on the phones list page for firmware version 1.9.0.26 but is not intelligent enough to stop sending CSTA requests. It's unclear if it can determine CSTA status for versions above 1.9.0.58 and should stop sending requests for earlier versions. @manfer, about the "Action URI Allowed IP List". The parameter value 'any' requires admin knowledge of the phone's provisioned password to use. I won't use templates with this setting as it's not a secure reason to relax security. VoIP fraud is growing. I suggest adding an IP list variable on the phone template and a new field in custom parameters for provisioning. In the meantime, I'll customize that parameter manually instead of using a template. @manfer 3CX updates the provisioning template with each Service Pack update, adding or removing functionality on phones to make them fully functional with the latest 3CX Phone System. If your custom templates are old and not synchronized with the latest 3CX templates, you'll miss functionality and incorrect behavior. The GXP2140 phones still experience ringing issues on firmware v1.9.0.26, despite previous attempts to resolve the problem. Manfer shared a CSTA parameter to potentially fix the issue: `1`. However, upgrading to firmware v1.9.0.58 or above is suggested as a more reliable solution. On this version of firmware, phones without CSTA enabled will respond with a "415 Unsopported Media Type" when receiving a CSTA INVITE request during registration, instead of ringing. This problem arises because the phone does not support CSTA. Conversely, phones with CSTA enabled will respond with a "200 OK" and still do not ring. The issue stems from 3CX sending CSTA INVITE requests to phones that they are aware don't support it. The recommended approach is to upgrade the firmware to the suggested version, apply provided templates, and verify if the problem resolves itself. This has been the only valid solution in the past. Although Aram expressed frustration with 3CX for not testing beta configurations, he also acknowledged the importance of understanding SIP messages for debugging VoIP issues. He took personal responsibility for not testing the SP3 version before upgrading and emphasized that templates are not the primary issue. It's worth noting that manual provisioning is a viable alternative to autoprovisioning, as long as phones are provisioned with correct SIP credentials. Grandstream phones have been extensively tested, including their P values, which can be found in official documentation. The author was initially unaware of CSTA support on newer firmware versions and mistakenly reported issues. Fortunately, other users have also encountered similar problems, highlighting the need for 3CX to clarify how they handle unsupported devices during registration requests. I've been experimenting with SIP RFC, but I don't have a deep understanding of how content type headers should be interpreted yet. However, it's likely that any phone without CSTA support would behave similarly to the Grandstream GXP21xx on firmware 1.9.0.26, which got fooled by the INVITE request. It seems clear to me now that 3CX could have easily avoided this issue if they had thoroughly tested their SP3 version on Grandstream phones. Not sending those INVITE requests to phones with firmware v1.9.0.26 or lower would've been a sensible approach, especially considering their experience with CSTA support for other phone brands. I wonder if they took the same precautions when introducing CSTA support for Yealink phones. It's puzzling that the firmware version information is used to display a warning on the 3CX management phone list page but wasn't utilized

2140 endpoints were stuck for days, with some threatening legal action for loss of business. I stand by my post and don't know how GS support can take over a day and a half to respond, only to provide responses that bear no solution to the problem. Please feel free to have a member of Grandstream management contact me. Regards, Jeff. Removed the CSTA_USER_AGENTS parameter setting, which included various GrandStream phone models, revealing an interesting catch. I'm tempted to test CSTA even with this change, and I've tested it on updated phones before, but I'm not sure if that was due to other changes or just a coincidence. The best way I found to update the phones was stopping SIP services from 3CX management console, which only required 2-3 services to be stopped while still keeping others running. This has been a really unfortunate issue, and it all points towards Grandstream phones rejecting CSTA requests below 1.0.9.58 instead of ringing non-stop. Unfortunately, 3CX added CSTA support without considering this could happen, and there was not enough warning for us. The good news is that I'm sure Grandstream phones will work much better with 3CX now that their engineers test and certify the firmwares. And when using Grandstream phones with 3CX, I'll definitely use those firmwares until a new version appears on 3CX's website. I did some further testing and spun up a brand new 3CX machine with a GXP2135 on 1.0.9.26 firmware. As soon as we set up the phone's account to 3CX, it started ringing - and stopped when I removed the parameter setting for Grandstream phones. To reliably update all phones to 1.0.9.58, you can set a TFTP server using SolarWinds' free TFTP server on a local Windows machine or your preferred solution. Download the needed Grandstream Firmware(s) from and place them in C:\TFTP-Root (or whatever your server's TFTP folder is set to). Use Putty to set the protocol, URL, and start the upgrade. Connect to the phone using the 3CX console phones tab, revealing the phone password, and issue the following commands: "upgrade set TFTP set URL 'ip address of TFTP server' (without quotes) commit upgrade yes". After all phones are on at least 1.0.7.97, you can replace the firmware file in C:\TFTP-Root with version 1.0.8.56. To force another update, use Putty again with just "upgrade, commit, upgrade, yes". Replace the firmware with 3CX's 1.0.9.58 after all phones are on that version. to revert my Grandstream GXP1628 devices back to a supported firmware version, I had to manually set the phone settings after upgrading them to the latest firmware. This involved setting the protocol to HTTP and the provisioning URL to the default 3CX URL, as some users have reported issues with TFTP. It's also recommended to switch to the default templates for a more streamlined configuration. ###ARTICLEclick again to start the firmware upgrade process. Starting Manual Firmware Upgrade for WP810 6. Once you click , a confirmation pop-up will be displayed on the WP810 LCD, click on “Yes” to confirm, after this the firmware will be uploading with the following message displayed on the Web UI Manual Upgrade In Progress for WP810 After the firmware is successfully uploaded the device will restart with the new firmware. Scenario 2: Upgrade using Grandstream Public HTTP Server Grandstream is hosting latest firmware files in a public HTTP server so customers can use it to directly upgrade their Grandstream devices with latest firmware. The same server hosts also BETA firmware when available. Follow below steps to successfully upgrade your device: Access the web interface of your device and go to the Maintenance → Upgrade and Provisioning settings page Make sure to select “Always Check for New Firmware”. Under “Firmware”, Select Upgrade via HTTP. Enter “firmware.grandstream.com” under Firmware Server Path. Press Save and Apply button to apply the new settings. Reboot the device and wait until the upgrade process is completed. Example of Upgrading using Grandstream Public HTTP Server on GHP62x Notes: To upgrade using Grandstream HTTP server, the device needs to be connected to Internet. To upgrade to BETA firmware (if available), use “firmware.grandstream.com/BETA” in step 4. Scenario 3: Upgrade using Local HTTP/ HTTPS/TFTP/FTP/FTPS Server Customers can use their own HTTP, HTTPS or TFTP server to upgrade Grandstream devices. First, download firmware files for the appropriate device model from . Unzip downloaded package and put extracted files in the root directory of your server. Devices and your server needs to be in same LAN. If using remote server, make sure to open/redirect ports in your router, so devices can download firmware files from it. Reminder: HTTP (TCP) default port is 80, HTTPS (TCP) default port is 443 and TFTP (UDP) default port is 69. Local Upgrade via HTTP Server Please refer to steps below for the local upgrade using HTTP File Server tool. Installing HTTP Server and Uploading Firmware File(s) Launch the install of the tool once it’s fully downloaded from the following link: “ ” Click on Run to launch the HTTP server. Starting the HTTP server Start the HFS server, browse to locate and select the required firmware files from your local directories by right-clicking on the root directory and selecting Add files. Selecting the firmware file to upload on the HTTP server Choose from your local directory where the firmware files are downloaded and click Open to upload the file(s) to your HTTP server. Uploading the firmware file to the HTTP Server Once uploaded to the HTTP server, the firmware file will be available. In our example, on the following link: “192.168.5.101/gxp2170fw.bin” as shown on the screenshot below (where 192.168.5.101 is the IP address of the computer running the local HTTP server). IP Address of the local HTTP Server Configuring Grandstream devices for local HTTP upgrade Access the web GUI of your device and navigate to “Upgrade and Provisioning” settings. Make sure to select “Always Check for New Firmware”. Select Upgrade via HTTP Enter the path of your HTTP server containing the firmware file under Firmware Server Path. Notes: In our example, we have configured the firmware server path as: “192.168.5.101“. Make sure to not include leading http:// in HTTP Firmware server path. Press Save and Apply at the bottom of the page to apply the new settings Reboot the device and wait until the upgrade process is completed. You can also verify the status of the upgrade progress on the HFS Server as displayed on the following screenshots: Firmware upgrade progress Firmware File Fully Downloaded Local Upgrade via HTTPS Server Please refer to steps below for the local upgrade using HTTPS. XAMPP with built in HTTPS server is available in this link (and can be used. Installing HTTPS Server Download appropriate version depending on yourTo upgrade Grandstream devices to a local HTTPS or TFTP server, XAMPP needs to be installed on Windows. First, download and launch the installation of XAMPP once it's fully downloaded by clicking the "Next" button. This will lead to the XAMPP Control Panel interface. To use the HTTPS server, start the Apache module. To list available firmware files on the root directory, access the local link address (from a computer running the HTTPS server. Note that XAMPP has built-in SSL certificates for HTTPS access, which can be changed by copying and pasting generated certificates into the "C:\xampp\apache\conf" folder. To configure Grandstream devices for a local HTTPS upgrade, navigate to the "Upgrade and Provisioning" settings in the device's web GUI. Select "Always Check for New Firmware," then choose "Upgrade via HTTPS." Enter the HTTPS server URL containing the firmware file in the "Firmware Server Path" field. For upgrading locally using TFTP protocol, users can download and install a free TFTP server from . Once installed, open TFTPD64. Ensure that the TFTP services are selected and started under Settings → Global. Browse to locate and select the required firmware from your local system. To configure Grandstream devices for local TFTP upgrade, access the web GUI of your device and navigate to "Upgrade and Provisioning" settings. Select "Always Check for New Firmware," then choose "Upgrade via TFTP." Enter the path of your TFTP server containing the firmware file under "Firmware Server Path." Lastly, users can also download a free FTP/FTPS server from . Choose the option "Download FileZilla Server" and launch the Install wizard to configure the FTP server for upgrading devices. Looking forward to setting up FTP user FTPClient on our local network For authentication, we need to choose the option “Require a password to log in” and enter the user’s password. FTP Sever settings On the computer running the FTP Sever, create a Folder containing the firmware files and copy the folder path. Native Path for FTP user Next, we add the copied folder path under “Native Path” and provide a name in “Virtual path”. Access mode for FTP user To configure the user’s rights, we choose one of the options in the “Access mode” drop-down menu. In this example, we selected “Read + Write”. Virtual path name should start with forward slash character / We also need to enable FTP Passive Mode by selecting the page “FTP and FTP over TLS (FTPS)” and clicking on the “Passive Mode” tab. Custom port range for FTP passive mode Using custom port range is necessary for establishing a data connection between client and server. Now that we have created a user, let's open Windows Defender Firewall with Advanced Security and create a “New Rule” under “Inboud Rules“. Port rule for the new inbound rule We need to allow connection on TCP ports 21 and 49152-65534 in the “Protocols and Ports”. Inbound rules for the FTP Sever Check the option “Allow connection” in “Action” and leave the “Profile” settings as default. New inbound rule name The last step is providing a “Name” and clicking on the Finish button. Configuring the FTPS Server To configure the FTPS server, we follow the same instructions and add the following steps : Select “Configure” from the “Server” Menu. Removing old entries Server listeners page After removing all the entries by clicking on the “Remove” button, enter “0.0.0.0” under Address, “21” in port and “Require explicit FTP over TLS” for Protocol. Explicit FTP over TLS configuration By default, Filezilla uses a self-signed X.509 TLS certificate. We can choose the minimum allowed TLS version by going to the “FTP and FTP over TLS (FTPS)” page from the server’s configuration settings. Firmware upgrade via FTP For Grandstream devices, we need to configure firmware upgrade via FTP: Access the Web GUI and navigate to “Upgrade and Provisioning” page. Firmware Upgrade and Provisioning In the “Provision” section, Set “Firmware Upgrade and Provisioning” to “Always Check for New Firmware”. Firmware Server Path The “Firmware Server Path” should follow this format : x.x.x.xVirtual Path Where x.x.x.x is the IP Address of the computer running the FTP Server and the Virtual Path is the one defined for the FTP User. Firmware Server Path example In this case, the IP address is 192.168.5.195 and the Virtual Path for the user we created (FTPClient) is “/Firmware”. Fill in the “Firmware Server Username” and the “Firmware Server Password” fields with the credentials of the FTP/FTPS user created. Example of configuring the Upgrade via FTP on GRP1x Press “Save and Apply” at the bottom of the page to apply the new settings. Reboot device for firmware upgrade The last step is to reboot the device and wait until the firmware upgrade process is completed. Automatic Firmware Update Automatic Firmware Update allows us to periodically check if a newer firmware is available to download and upgrade the device. This option will help to keep the devices up-to-date. Enabling automatic firmware update from web configuration interface Upgrade provisioning settings can be utilized to streamline the upgrade process . for instance , an example of configuring automatic upgrade on gsc3610 can be achieved through several options : - every interval in minutes - every day , specifying the hour of the day - every week , specifying both the day and hour of the week once these options are set , if a firmware update is available , it will be downloaded and the device will be upgraded automatically . furthermore , users can configure firmware file prefixes and postfixes to ensure that only matching firmware updates are downloaded and installed . these settings can be configured through the web gui under maintenance , upgrade , and provisioning . for example , setting a firmware file prefix and postfix can help users store different firmware versions in the same folder and upgrade to a specific version . in addition , users can configure a firmware server username and password to authenticate access to the firmware files . to initiate the firmware upgrade process , the phone sends an initial request to download firmware files from the server . if the server requires authentication , the phone will send the configured credentials to access the firmware files . notably , some devices support various upgrade methods , including http , https , tftp , and ftp . overall , these features enable efficient and secure firmware upgrades for a range of devices .