



IoT Solution Optimizer

FAQ: Service Version 2.3

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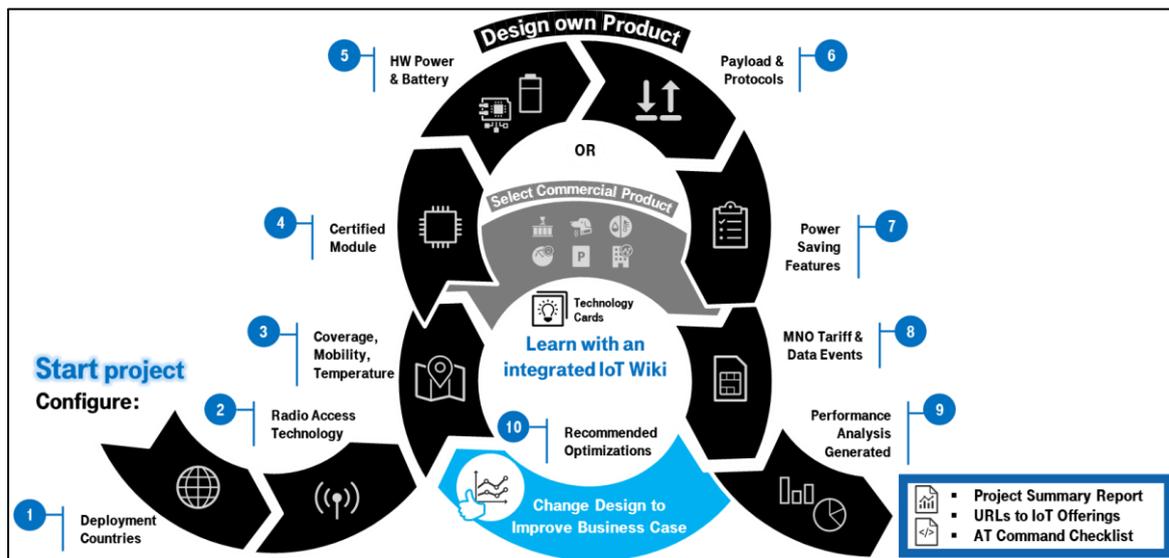
1. Introduction

Thank you for using the IoT Solution Optimizer, a cloud-based that helps enterprises shorten their time to market by showing them how to quickly optimize IoT solutions for Mobile IoT deployments. In this document, you can find a listing of frequently asked questions.

What is the IoT Solution Optimizer service?

The IoT Solution Optimizer service is a powerful tool that can help you bridge the supplier fragmentation affecting the IoT industry, by combining the expertise of various segments (radio modules, batteries, IoT applications, network infrastructure) into one experience that guides you through the development of more power-efficient Mobile IoT solutions. Within minutes, you can compose your own design by selecting hardware components and characterizing your application's intended behavior. Best network features are presented in parallel, with insights on how they can be used to maximize investments. In case that you prefer to work with a standard product offering, you may conveniently select from among the numerous products integrated into the service's solution shelves. After you finish configuring the deployment scenario for your product, the IoT Solution Optimizer models device performance, delivering reliable results and multiple optimization opportunities. An analysis that would have previously taken several man-weeks of investigation to complete, is now delivered in just seconds. This improves you time-to-market, by empowering you to identify risks, ensure proper integration of feature support, and weigh-out design choices. Figure 1 shows the usage flow of the IoT Solution Optimizer.

Figure 1: IoT Solution Optimizer Project Creation Flow



Who is the IoT Solution Optimizer service targeted for?

The main audience for the IoT Solution Optimizer consists of enterprises that are deploying M2M/IoT applications across the globe, service integrators, IoT device component suppliers, software developers and mobile network operators.

2. Technical Considerations

How can I access the IoT Solution Optimizer?

There are two URLs that may be used to reach the IoT Solution Optimizer service worldwide via the Internet:

- www.solutionoptimizer.iot.telekom.com
- www.iotsolutionoptimizer.com

Can I use the IoT Solution Optimizer on my smartphone?

The user interface is based on a secure Azure Web App compatible with most PC browsers. Currently, the service is not optimized for use on small-screen devices, such as smartphones, as there is no mobile version of the application available for users.

What PC browser is recommended for using the IoT Solution Optimizer?

For the best experience with the IoT Solution Optimizer, it is recommended to use the latest version of Firefox, Chrome, Internet Explorer, Microsoft Edge, or Safari. Although the IoT Solution Optimizer Web App may also operate with other browsers, unforeseen technical issues may occur.

Why do some user interface elements of the IoT Solution Optimizer not work after an update?

With each major update of the IoT Solution Optimizer, it may be necessary to periodically clear your browser's cache. This allows you to properly render and use new features which are implemented per release. Please also delete any stored cookies and Javascript under browser settings.

Do I need to install any other applications or plugin add-ons?

You may need to install the Adobe PDF Reader browser plugin add-on for in-browser viewing of PDFs if it is already not available.

What should I do to troubleshoot my installation?

In case you encounter technical issues with your browser, it is possible to troubleshoot the installation by following these simple steps:

1. Install the latest, available browser versions,
2. Clear the browser's cache,
3. Try a different browser and/or different computer.
4. Still having problems? If a technical issue persists, please report the problem to our Tool Support (refer to the Contact page at the footer of the web service).

How can I quickly identify if I have a local issue with my browser or PC?

It may be beneficial to have more than one browser installed on your computer. If you run into problems while using the IoT Solution Optimizer, move to another browser, as it may resolve the issue. You can also try moving to a different computer to see if the problem persists. This may help to identify whether the issue was a problem with your browser or computer, or with the IoT Solution Optimizer.

3. Welcome! Page

Is the landing page always the same for all users?

No. Depending on your account credentials and the sub-domain you use, you may have access to other web services besides the IoT Solution Optimizer. The landing page looks different for these customers. For those users who only have access to the IoT Solution Optimizer, the "Welcome!" page is also their landing page once they log-in.

What is the function of the breadcrumbs at the top of the page?

The IoT Solution Optimizer's header menu bar is found just underneath the mobile network operator branding at the top. Breadcrumbs on the left-hand side form a horizontal list of hierarchical pages, allowing you to go back to the "Welcome!" page at any time once you begin navigating through the rest of the service.

Where do I find the IoT Solution Optimizer user guide?

The "Welcome!" page includes links just above its footer to download the latest version of the user guide.

3.1. Terms & Conditions of Service Usage

Is it necessary to accept the "Terms & Conditions of Service Usage?"

In order to start using the IoT Solution Optimizer service, it is required to accept the Terms & Conditions. These can be read by selecting the colored words "Terms & Conditions" on the "Welcome!" page, or via the link integrated into the footer of the browser window. By selecting the tick box next to "Terms & Conditions," users acknowledge that they have read

and fully agree to the IoT Solution Optimizer’s web service usage and privacy policies. Failure to accept these prevents usage of the IoT Solution Optimizer.

Where can I go to review the “Terms & Conditions of Service Usage” that I accepted?

The footer of the IoT Solution Optimizer embeds a link that loads a copy of the current IoT Solution Optimizer “Terms & Conditions of Service Usage;” these open on the same browser window. Alternatively, the “Welcome!” page link displays the same content in an overlay window.

Why am I being prompted to accept again the “Terms & Conditions of Service Usage?”

From time-to-time, the “Terms & Conditions of Service Usage” are updated, requiring users to accept the new agreement before being able to continue using the service.

Can I change my mind and not accept the “Terms & Conditions of Service Usage” anymore?

Once the agreement is accepted, it not possible to deselect the tick box. If you do not want to use the IoT Solution Optimizer under the accepted conditions any further, please first delete your account under “My Account”, then contact the IoT Solution Optimizer’s Tool Support team (refer to the “Contact” link at the footer of the web service). We will deactivate your account accordingly.

How can I delete my account?

The option to delete your account is located under the “My Account” feature; please refer to Chapter 3.2. Choosing to delete your account will irrevocably erase all personal data associated with your account, thereby fully anonymizing your project data.

What happens to my project data once my account expires or is deleted?

As part of the accepted Terms & Conditions for use of service, users explicit grant the service provider the right to collect performance metrics regarding their projects. Specifically, project data is used for the purpose of improving the IoT Solution Optimizer web service, as well as in trend analyses of successful (and unsuccessful) M2M or IoT product designs, or their aspects. It is important to note that the IoT Solution Optimizer’s analysis algorithms do not include any private data associated with user accounts or their association to project data. This is important to highlight, as the IoT Solution Optimizer is fully compliant with the data privacy laws of the Federal Republic of Germany, which are among the strictest worldwide.

When your account expires or is deleted, your personal data is automatically erased from the system and your project data is being anonymized. It not possible to correlate anonymized data to a specific user account, or to restore a user’s projects in case they

decide to activate a new account later on. By default, your anonymized project data is archived for a period of four years, after which it is finally purged automatically by the system.

Can I also permanently delete my project data along with my account?

If you want to also have your project data deleted with your account, please contact Tool Support before deleting your account to request this in writing. We can purge your account and project data in one action, thereby avoiding an archiving of anonymized project data. A confirmation of deletion will be sent to you via e-mail.

3.2.My Account

Where are all account administration functions of the IoT Solution Optimizer service located?

The "My Account" feature contains all account administration functions of the IoT Solution Optimizer service. This is located on the right-hand side of the header main menu bar, as submenus appearing when the account holder's username (typically an e-mail address) is selected. The drop-down list of account management features contains "My Account" and "Log out" options.

What account information can I manage under "My Account?"

Under "My Account," you can update your contact information, consisting of first name, last name, phone number, mobile number, e-mail address, company name and company address. Mandatory fields are marked with "*".

Please note that a security question and answer can also be defined here, in case that account credentials are lost. Furthermore, there is a tick-box to give consent to receive e-mail notifications from the service, e.g. on expiration of one's account. You can conveniently unsubscribe anytime from receiving alert messages from the service by deselecting this box.

How can I be notified of major and minor updates to the IoT Solution Optimizer service?

Under "My Account," please select the tick-box to give consent to receive e-mail notifications from the service. With this feature, you can conveniently unsubscribe anytime from receiving alert messages from the service by deselecting this box. Due to EU regulation, this tick-box is unchecked by default.

How can I be notified when my IoT Solution Optimizer license will expire?

Under "My Account," please select the tick-box to give consent to receive e-mail notifications from the service. Due to EU regulation, this tick-box is unchecked by default.

3.2.1. Change Password

How can I change my password for accessing the IoT Solution Optimizer service?

The "Change password" button is located in the "My Account" page, which is accessible on the right-hand side of the header menu bar, under the account holder's username (typically an e-mail address). You will be asked to confirm your current password and enter a new password twice. By selecting the "Update password" button, your account will be updated with the new credentials.

3.2.2. Two-factor Authentication

How can I configure the two-factor authentication for the IoT Solution Optimizer?

The "Two-factor Authentication" button is located in the "My Account" page. You can disable two-factor authentication or reset your recovery codes. Likewise, the Authenticator app can be reconfigured, with the authenticator key reset.

Do I need to use a specific smartphone application for the two-factor authentication?

Configuration of two-factor authentication is done using any smartphone authenticator app, which can scan the QR code shown in the IoT Solution Optimizer administration menu. The verification code given by the smartphone authenticator app is simply entered in the field on the screen.

3.3. Tool Support

How do I contact the IoT Solution Optimizer Tool Support team?

You can contact the IoT Solution Optimizer's Tool Support (refer to the "Contact" link at the footer of the web service). This option is conveniently integrated into the footer of the service's webpages.

What is the typical turn-around time for support from the IoT Solution Optimizer Tool Support team?

Please allow a response time of 1-3 business days.

4. My Projects

Where are my project reports and configurations stored?

Only after “Terms & Conditions of Usage” are accepted, will the main menu option “My Projects” appear.

You can conveniently browse and edit your projects in the “My Projects” page. This feature can be accessed either via the “Welcome!” page’s main menu option, or via the breadcrumb in the webpage header menu bar. Both in-progress and completed projects are displayed in table format.

How are my projects organized under the “My Projects” page?

The projects in the “My Projects” page are listed in rows that serve as a folder repository up to three project-specific documents. Projects are organized according to editing date, with the most recently created or modified at the top. By using the filtering options available under each column, you can quickly define a search mask or filter to sort your numerous projects.

What do the buttons on the right-hand side of the “My Projects” page do?

The buttons to the right of each project allow you to rename, edit, delete, or copy projects. Not only can you edit a project by selecting the pencil icon in the “Actions” area of the table, but you can also modify it by selecting its name under the “Project Name” column. If a project is copied, users are asked to give the replicated configuration a unique name.

What documents appear in each project “row” of the “My Projects” page?

The projects in the “My Projects” page are listed in rows that serve as a folder repository up to three project-specific documents. These files are accessed by selecting the twisty to the left of the project name. Those projects which are not finished yet have no files and display the text, “Project files will be generated once you finish your project.” Completed projects have a “Project Summary Report,” an “AT Command Guide” (for custom designed products only), as well as a localized onboarding card generated.

Why are the project documents in “My Projects” changing occasionally?

All project files in “My Projects” are regenerated each time that your project is modified, or the underlying configuration database of the IoT Solution Optimizer is updated by Tool Support. It is therefore essential to save your project files locally in case that you want to record the configuration and performance of a specific design.

5. Create New Project

How can I create a new project with the IoT Solution Optimizer?

Only after "Terms & Conditions of Service Usage" are accepted, will the main menu option "Create New Project" appear.

You can start a new project in the IoT Solution Optimizer by selecting this main menu option. This loads the "Create New Project" page, where you must assign your project a unique name and select "Next." Once a name has been given to a project, it appears in your "My Projects" page with a dedicated project folder. Please note that it is not possible to give the same name to more than one project. The service will prompt with an error message requesting one to change the name before saving.

6. Service Wizard

Where is the Service Wizard?

The Service Wizard is implemented as a cluster of large, interconnected circles (each of which represents major "stages" in the configuration flow of products), and smaller nodes in-between (representing individual configuration pages). The wizard is implemented at the top of all IoT Solution Optimizer project configuration pages. The stages in the project configuration flow are: "Solution Profiling," "Hardware," "Application," "Deployment," and the "Project Summary Report."

What is the purpose of the Service Wizard?

The wizard serves two key purposes:

- Firstly, it highlights where you are currently within the project configuration flow. Unfinished nodes and stages are grey. Once you complete a configuration page, the node or stage changes color. By hovering the cursor over each node, a pop-up appears showing the name of each page. The user can therefore see all completed and pending configuration tasks.
- Secondly, you can select the colored wizard nodes to navigate back and forward through your projects to reconfigure different elements of the design. By going back to change an element in a project, the IoT Solution Optimizer will perform a plausibility check on the rest of the design and inform you whenever a subsequent page may require reconfiguration. For example, changing the deployment network to one which does not support some 3GPP™ features may require you to reconfigure previously-selected power saving features later on in the configuration flow.

Why does the Service Wizard expand once I complete the “Product Shelf” node?

If under the “Product Shelf” node you decide to create a custom design, the following five additional nodes are necessary to configure, and the Service Wizard adapts accordingly:

- “Module or Chipset” – Select 3GPP™ modem certified in chosen market(s)
- “Hardware Power” – Define the power consumption of other components
- “Battery” – Configure the power source of the IoT device
- “Communication Activity” – A wizard that defines IoT application payload, protocols, and tariff for application messages and firmware updates
- “Power Saving Features” – Configure corresponding 3GPP™ features

Why doesn’t the Service Wizard show all possible nodes of the project configuration flow?

Selecting a pre-configured product off the IoT Solution Optimizer’s product shelf (in the “Product Shelf” page) skips several configuration steps and brings you to the “Data Events” page under “Communication Activity.” The product’s hardware and application configuration is treated as a “black box” which cannot be modified. In practice, this is the case for standard offerings. For more information about components and the design of the selected product, please contact its vendor. Please check the corresponding product specification, found under the “More info” button of the respective product in the “Product Shelf” page.

6.1.IoT Vertical

Why is it necessary to pick an M2M/IoT vertical?

You need to always assign an M2M/IoT vertical industry to your projects. This step allows us to associate its data and performance with similar product designs. Not only does this step help pre-configure subsequent input pages with reference values for each vertical industry, but it aids the IoT Solution Optimizer in organizing the collected data into use case “silos” for machine learning algorithms and business intelligence.

Why are the verticals not organized into categories?

Verticals are purposely not organized into categories on this page to encourage users to consider which best-fits their project. For example, a sensor mounted on a bicycle may be an “asset tracker” if used for security purposes, “health” if used in conjunction with a health monitoring application, “condition monitoring” for assessing wear and tear or vibration on its mechanical components, or “x-sharing” if used in a “rent the bike” commercial model. There are subtle differences between each of the M2M/IoT applications, even if at the end the product is physically mounted on a bicycle. Please consider the numerous

characteristics of your use case carefully when trying to match your project to an M2M/IoT vertical.

I do not find a matching vertical for my project. What can I do?

If a specific vertical industry is missing for your intended use case, please use “Contact” link integrated at the footer of the page to address your needs to the service administrators.

Please note that the integration of new M2M/IoT verticals to the IoT Solution Optimizer is independent of its service releases. That means that additional options may become available independently of regularly scheduled updates.

6.2.Mobile Operator Networks

Why does it matter, which mobile network operator I pick?

The IoT Solution Optimizer can be used to model the performance of M2M and IoT solutions on different mobile network operator (MNO) networks. Each network has been characterized in the service’s database according to its available 3GPP™ radio access technology, network features and parametrization, as well as band support. By selecting one or more deployment networks, the IoT Solution Optimizer adapts the configuration options presented to you in subsequent pages. For instance, a specific network may not support LTE-M radio access technology, or specific power saving features. Furthermore, some chipsets or modules may not support the network bands of a specific market, or even be allowed by that MNO on their network.

Why are many operator networks not available for selection?

In its first service releases, the IoT Solution Optimizer is integrating two Mobile IoT, Low Power Wide Area (LPWA) 3GPP™ WAN technologies: NarrowBand IoT (NB-IoT) and LTE-M (eMTC). Operator networks that have not commercially deployed these technologies cannot be offered. Only after these operators have confirmed through certification processes that specific wireless communication chipsets and modules interoperate properly, does it make sense to integrate them into the service.

Over time, it is planned to integrate additional mobile network operators (MNOs) into the IoT Solution Optimizer. This will allow for modeling of device performance in multiple markets across the world. Please note that the integration of new MNOs to the IoT Solution Optimizer is to a large extent independent of its service releases. That means that additional countries may become available independently of regularly scheduled updates.

Why can I only pick one mobile network operator per country?

The IoT Solution Optimizer is currently configured to only model one mobile network operator (MNOs) per market.

What is a tariff country?

When multiple networks are selected, an option appears just below the interactive map asking you to select the flag of the country where the tariff will be booked; in essence, this is referring to the mobile network operator (MNO) that will be your business partner for 3GPP™ WAN connectivity. By hovering the cursor over the flag or country, the MNO's name is displayed in a pop-up. Only one flag can be selected per project. In some cases, a "SIM lock" has been applied to the service, meaning that you are forced to select a specific tariff country, or one out of a group of countries.

What is the percentages below each selected country mean?

As you may deploy a product across the footprint of multiple countries, an option is given to specify the percentage of devices, or the percentage of time that devices are found in each market. The IoT Solution Optimizer will model the performance of the configured product in each market and apply these percentages as a weighting factor in the project analysis.

6.3. Access Technology

What determines which Radio Access Technologies are shown on the pick list?

Once you have selected one or several networks to deploy your IoT application, the available Radio Access Technologies (RAT) in those markets are shown on this list. In early 2021, the IoT Solution Optimizer will roll-out support for an additional Low Power Wide Area 3GPP™ WAN technology, LTE-M (eMTC).

Can I model multimode use cases?

Currently, the IoT Solution Optimizer supports modeling only one Radio Access Technology (RAT), NarrowBand IoT (NB-IoT). The capability to do performance assessments of multimode products is only necessary once LTE-M (eMTC) becomes available in the upcoming Service Version 3.1.2 maintenance drop. Additional features, such as a Technology Selection Guide is planned to complement the experience, helping users understand which technology choice(s) are best fit for their IoT application.

When will LTE-M modeling be possible?

Although LTE-M (eMTC) is currently shown on the user interface for select markets, the modeling of this technology only becomes possible in the upcoming Service Version 3.1.2 maintenance drop.

When will 2G and 5G modeling be possible?

Although most 2G solutions are not battery-powered, several battery-powered Mobile IoT solutions support 2G fallback in case that the devices leave the Mobile IoT coverage footprint. Currently we are assessing if this technology should be included as part of the roadmap.

Similar challenges that currently affect NB-IoT and LTE-M productization for low-bandwidth, battery-powered devices needing to perform with battery lives of several years will impact a future category of high-bandwidth, battery-powered 5G devices needing to perform with battery lives of several days. 5G is currently included in the IoT Solution Optimizer's roadmap for an early-2022 release.

Why are 3G or LTE Radio Access Technologies (RAT) not offered?

Most 3G (UMTS) and LTE (4G Cat.1+) solutions are not battery powered. There is little business demand to offer this capability, as evidenced by the decade-long classical M2M business, which has performed well to-date. As the IoT Solution Optimizer currently focuses on power optimization, there is no intent to develop modeling capabilities for 3G and LTE products.

6.4. Deployment Characteristics

How can I correlate Outdoor / Indoor / Deep Indoor coverage to my real deployment scenario?

Coverage conditions will vary, even outdoors, within a single street. It is important to note that the IoT Solution Optimizer intends to give you an approximation of IoT device performance in various coverage conditions. The picture presented on this page may help illustrate what scenarios you may face in reality. The more isolated a device finds itself from the radiation source, the weaker the signal may be. Different types of land-use (dense urban, urban, rural) all have an impact on signal propagation and reflections. Foliage in parks or forests can reduce signal quality during part of the year. Even in-car penetration losses of 5 – 7 dB may lead to Indoor coverage conditions. As a rule of thumb, Outdoor refers to good coverage, Indoor represents poor coverage, whereas Deep Indoor consists of very poor coverage, where GSM, 3G or LTE signals cannot be received. "Technology Cards" are available within the page to explain more details.

What do the percentages of Outdoor / Indoor / Deep Indoor coverage mean?

Please configure the percentage of the population of devices that will find itself in each coverage quality. Alternatively, you can view the percentage as portion of operating lifetime that each device will spend on average within each of the three coverage conditions. The

IoT Solution Optimizer will run its performance modeling for a 100% deployment in each environment, as well as for the composite deployment based in the inputs you gave.

Why should I define the temperature range for my deployment?

By configuring the minimum and maximum temperature that your device is exposed to, we can filter the database to remove devices and components which would not properly operate at those extremes. This gives you the assurance that only products that are rated to operate in your intended deployment temperatures are shown. The average value is also critical because it is used to model the battery capacity, which is affected by temperature. The latter is used to find suitable batteries in the "Battery Selection Guide" feature, as well as to model the battery life of your project.

What is considered when I select "Mobile" under the Mobility feature?

The mobility channel model can be configured via a toggling switch. You can specify "Mobile" in case that the IoT device is deployed on a vehicle or will regularly exchange messages with its server from different regions of the same network, or beyond. By choosing a "Mobile," the IoT Solution Optimizer will consider that the wireless chipset or module will need to periodically perform a Tracking Area Update (TAU) once it enters a new Tracking Area, which is a portion of the Radio Access Network grouped into a paging area. This TAU is factored into the power consumption calculations.

Why does the geographical distance that devices travel between messages matter?

Tracking Area Updates (TAU) are performed whenever IoT devices enter a new Tracking Area. As the IoT Solution Optimizer knows how many Tracking Areas are in each network you selected, as well as the size of each market, a probability can be calculated specifying how often such a TAU will be performed, on average.

What is considered when I enable "Roaming" under the Mobility feature?

M2M/IoT devices that are roaming will need to perform a system scan to search for NarrowBand IoT or LTE-M coverage once the home network is left. Depending on the wireless communication chipset or module used, such scans may be power intensive. As such, it is important specify how often an IoT device will roam on average into adjacent networks. This will help determine how much power consumption should be accounted for in the performance modeling.

How can I reduce power consumption due to mobility aspects?

As part of best-design practice, please consider restricting the operating bands of your device to enable only those frequencies and Radio Access Technologies which you intend to use. More information on what AT command is employed for this purpose can be found in the "AT Command Guideline."

6.5.Product Shelf

Where do I find standard product offerings in the IoT Solution Optimizer?

The IoT Solution Optimizer allows you to model either pre-configured “standard offering” products, such as M2M/IoT vertical solutions, or custom-defined designs. The latter option is particularly valuable for those enterprises wishing to design their own IoT devices and applications. By using the IoT Solution Optimizer, companies can quickly identify the trade-offs between different design options, and avoid mistakes or limitations affecting their business case. The selection of which path to take for each project is done in the “Product Shelf” page. Pre-integrated solutions in the IoT Solution Optimizer’s product shelf are offered just below “Design your own custom product” in the page’s selection accordion. The displayed offering of products will change depending on which vertical you picked on the previous page.

How can I have my product integrated into the IoT Solution Optimizer?

If you would like to learn more about integrating your product to our product shelf, please contact the Tool Support team via the “Contact” link available in the webpage footer.

An integration of your device can include your company logo, product picture and its key selling points. A product specification or 1-Page marketing sheet may be opened as a separate browser tab by selecting the “More Info” button. Wherever a product has been integrated into a mobile network operator’s cloud, it is possible to place a corresponding icon to the left-hand side indicating cloud API support.

Why are no standard product offerings available for selection?

If no product has been placed yet on the virtual product shelf of the IoT vertical you chose, this may happen. Please note that the integration of new M2M/IoT standard offerings to the IoT Solution Optimizer virtual product shelves is independent of its service releases. That means that new products may become available independently of regularly scheduled updates

How can I model my own custom design?

Custom-defined designs are offered as the first option in this page’s selection accordion. This option looks the same regardless of which vertical you picked on the previous page. A bulleted list appears when you open the twisty, highlighting which steps must be completed in order to properly configure a custom solution design. “Technology Card” links are available to give more information regarding each step. The diagram also illustrates the number of additional nodes that will appear in the Service Wizard once this option is selected.

6.6.Module or Chipset

Why can't I configure the wireless communication chipset or module for my project?

This option is only available for your project if you decided to build a custom-defined design. Products that are selected off the virtual product shelf cannot be customized.

Why can't I find some wireless communication chipsets and modules available on the market?

Since the first commercial launches of NarrowBand IoT, several mobile network operators have invested to scale up their M2M and IoT business by certifying portfolios of Mobile IoT radio chipsets and modules. This secures best-in-class quality for connectivity, faster time-to-market, and a wider range of implementation choices for customers.

Our current certification list includes numerous single-mode (NB-IoT) and multi-mode (NB-IoT, LTE-M, 2G) solutions from suppliers worldwide. By collaborating closely with the industry, the partners of the IoT Solution Optimizer ecosystem aim to scale-up the IoT business. Each integrated modem in the component shelf is assessed for performance (power consumption, throughput, latency) as well as interoperability against key features of the various mobile operator networks. As new features and performance improvements are made to the chipset and modules during their product lifecycle, the IoT Solution Optimizer database is updated to reflect these enhancements. Please refer to the firmware and hardware versions of the selected chipset or module at the bottom of the Project Summary Report.

Why is the list of wireless communication chipsets and modules dependent on the market(s) I select?

Each Mobile IoT radio chipset and module supports a specific combination of radio frequency bands. In addition, these chipsets and modules may be certified for a different subset of mobile network operators. As such, by selecting specific networks for your deployment, we cross-check chipset and module support of the deployed frequency bands in those networks, as well as successful completion of a technical certification for these networks. This ensures that you only see products that are proven to work well on the networks you need.

How are wireless communication chipsets and modules integrated into the IoT Solution Optimizer?

After a successful evaluation of a module or chipset product, collaborating mobile network operators spend minimally three days with it, collecting detailed power measurements on the live network. This allows the IoT Solution Optimizer to properly characterize the performance of this IoT device component, and accurately model it under numerous signal conditions and payload sizes. All measurements are performed in very conservative

network signal conditions, near the edge of each Coverage Enhancement (CE) level, on both the uplink (from IoT device to the mobile network operator's (MNO) eNodeB) and downlink (from the eNodeB to the IoT device). Please refer to the CE-Level RSRP and SINR values of the selected chipset or module at the end of the Project Summary Report. The following figures are indicative examples of the poor network conditions under which measurements may be taken:

- Coverage Enhancement (CE)-Level 0: RSRP: -112 dBm, SINR: 9 dB
- Coverage Enhancement (CE)-Level 1: RSRP: -122 dBm, SINR: 1 dB
- Coverage Enhancement (CE)-Level 2: RSRP: -133 dBm, SINR: -8 dB

Should I pick a wireless communication chipset instead of a module for my IoT device?

Pre-integrated modules and chipset are displayed in separate accordions. In most cases, enterprises select a wireless communication module. The sensitivity of radio circuits, as well as the accuracy of layouts and components required to achieve operation on a specific frequency, mean that only large enterprises with significant R&D investment opt to integrate chipsets directly. Furthermore, due to the legal regulations imposed on radiated emissions, radio circuits are usually subject to conformance testing and certification by a standardization body such as ETSI or the Federal Communications Commission (FCC). This means that engineers often prefer to "drop in" a pre-certified radio module rather than attempt to implement an own RF design. Radio modules are steered by the IoT device application via an AT command interface.

Please note that some of the chipset suppliers offered in the IoT Solution Optimizer pick list may not offer direct sales to customers. It is necessary to work in those cases with an OEM module supplier.

6.7. Hardware Power

Why can't I configure the hardware power for my project?

This option is only available for your project if you decided to build a custom-defined design. Products that are selected off the virtual product shelf cannot be customized.

Should I use a voltage regulation?

In the upper part of the Hardware Power screen, you can configure the voltage regulation you may want to use for your project. Currently, configuring DC/DC converters or other switching regulator is not supported. A Low-dropout Regulator (LDO) can be however configured, if needed.

LDOs are linear voltage regulators that support a small (= low) voltage drop between the input voltage (V_i) and output voltage (V_o), generally below 500mV. Unlike standard linear voltage regulators, which require typically a 2-Volt differential voltage between input and output to work properly, LDOs work well even when the difference between the two is very small, being able to regulate down to less than 100mV. That said, the ability to reject noise and ripple from the input supply significantly reduces below ca. 500mV, which may become an issue with many LDOs. A key benefit of using an LDO is that it protects more expensive, connected loads from voltage transients, current surges, reverse voltage, power supply noise, etc.

For most applications, using an LDO regulator makes sense if the input voltage is no more than a few volts above the output voltage; otherwise, the regulator will consume too much power, and a more efficient switching regulator (DC/DC Converter, for instance) could become a better implementation option.

What does the lower part of the configuration screen represent?

When designing an IoT device for Mobile IoT use cases, it is necessary to carefully plan the power consumption of all hardware components apart from the wireless communication module or chipset, and the efficiency of the battery. Some IoT applications may take advantage of the module's capability to enter a "deep sleep mode" with microAmp current consumption. That said, the rest of the hardware continues to consume power, for instance, to run an IoT device application on the microcontroller, to ping sensors or actuators managing an asset, or to obtain positioning data from a GPS receiver. The average current drain at any given time is therefore non-zero and use case (IoT vertical)-specific. In order to properly model the performance of any IoT service, one must consider these critical design aspects. The IoT Solution Optimizer currently approximates the impact of such hardware inefficiencies and power drain.

Should I configure the hardware power consumption using the "Constant" or "Wake-up & Sleep" options?

Two options exist for completing the "Hardware Power" page:

- In the "**Constant**" configuration, you are required to define the average current consumption between any two bi-directional data transaction events. As a word of caution, please take note that the default unit here is microAmps; placing a very large number here may skew the results of your simulation.
- In case that you want to model the hardware power consumption more accurately, you may elect to use the "**Wake-up & Sleep**" configuration option. Here, you define in the first entry field an average current consumption during the "wake-up time" window associated with bi-directional data transaction events. This may represent a power surge during the operation of the device; for example, it may represent the brief moments in time when the application on the microcontroller

or GPS receiver are active. In-between such peaks of activity, there may be much lower power consumption on average; a different average current consumption value can thus be configured separately for this “sleep time” window of time in the second entry field.

Why do I need to specify a maximum peak current for the hardware components?

You are encouraged to specify the maximum peak current for the hardware components on this screen. This has a direct impact on which batteries are presented in the next step of the project configuration flow, the “Battery” screen. By not doing this, you may run the risk that your selected battery cannot power some of the components in your device.

How do I configure this screen if I do not have any measurement data yet for my IoT device?

The IoT Solution Optimizer populates these fields with typical values observed from the industry. The average current drain at any given time is non-zero and use case (IoT vertical)-specific. You can choose to leave the values at the defaults that we offer, or you may set them to zero in case that you do not want to account for the hardware power consumption in your modeling.

6.8. Battery

Why can't I configure the battery for my project?

This option is only available for your project if you decided to build a custom-defined design. IoT device products (e.g. asset trackers, environmental sensors, wearables, etc.) that are selected off of the virtual product shelf cannot be customized.

Why are only Saft batteries offered in the IoT Solution Optimizer?

Unlike wireless communications chipsets and modules, which are specified by the 3GPP™ standard, and therefore behave quite similarly, battery performance is quite analog, often depending heavily on proprietary production processes, architectures and chemistries used in the cells. It would be nearly impossible to create an accurate model which can characterize a broad supplier industry of batteries, such as what has been done for 3GPP™ chipsets and modules.

In light of this, the service owner of the IoT Solution Optimizer has signed a partnership with Saft A.S. (www.saftbatteries.com) to do approximate modeling of their technologies in the IoT Solution Optimizer. This capability is currently limited to Lithium-Thionyl Chloride (Li-SOCl₂) and Lithium-Manganese Oxide (Li-MnO₂) batteries suitable for Mobile IoT applications.

By selecting Saft batteries for your design, you can leverage special algorithms developed jointly with Saft experts. Each Saft product entry in the accordion consists of a product picture and key selling points. A product specification or 1-Page marketing sheet may be opened as a separate browser tab by selecting the "More Info" button. These specifications include contact information in case that you would like to learn more about Saft's battery products. In Service Version 2.0 Drop 2, a "Product Specification Request" (PSR) form will be generated in the corresponding "My Projects" folder. This sheet can be filled out and supplied to Saft representatives for technical support.

How do I model alternative battery supplier products?

You can opt to define a custom battery; this is the default option that is offered in the IoT Solution Optimizer. This will require you to specify the nominal voltage, capacity and yearly self-discharge percentage. The modeling performed with this feature is just a rough approximation, as there are numerous aspects which are not considered – such as the impact of temperature, chemical decompositions and internal battery architecture.

How does the "Battery Selection Guide" work?

A grey pop-up appears when the cursor is hovered over the accordion. By selecting the option "Learn more," you can launch the "Battery Selection Guide" feature. This optimization feature can help you identify best-fit batteries for your use case. Different characteristics are presented vertically on the interactive card, including the expected operating temperature range of the IoT device, the expected battery life, electronics type, and the battery configuration (number of batteries connected in serial and parallel). By selecting those aspects of the product design which may be more critical for you, the IoT Solution Optimizer can assess the integrated Saft S.A. products and propose those batteries best suited for the IoT application and its deployment environment. After pressing "OK," a list of potential batteries may be presented. You can either select one of these to advance to the "Communication Activity" page or leave the card by simply clicking the user interface outside of it.

How can I account for temperature impacts on battery performance?

You can configure the temperature range of your IoT device's operation on the "Deployment Characteristics" page. The temperature you set is shown in the Battery Selection Guide feature. If you would like to find batteries for a different temperature range, please revert to the "Deployment Characteristics" page and change the global temperature settings for your project. Please note that the average temperature is what is used to model batteries in the IoT Solution Optimizer and the Battery Selection Guide.

6.9.Communication Activity

Why can't I configure application messages, payload size, and protocols for my project?

This option is only available for your project if you decided to build a custom-defined design. Commercial devices that are selected off the virtual product shelf cannot be customized.

Why can't I advance past this screen?

The "Next" button is only active if you have successfully completed at least one application message or firmware/software update. Messages which are still in draft state are ignored if the calculation engine is run at the end of a project.

Can I configure multiple types of communication events?

M2M/IoT applications may require different types of messages to be scheduled and exchanged. Consider, for instance, an application that sends hourly temperature reports, weekly maintenance logs, and yearly firmware updates. In order to properly model such complex communication patterns, the IoT Solution Optimizer implements capabilities allowing such scheduled interactions to be properly configured and considered in a performance analysis. Simply add new messages in the "Communication Activity" configuration page by selecting the corresponding button above the message table.

What are uplink and downlink messages?

Uplink messages constitute M2M/IoT device application-originated messages to the server, whereas downlink messages are server application-originated messages sent to the IoT device. Uplink payload is initially sent to the server after a Random-Access Procedure and set-up of an RRC bearer. Downlink payload, in turn, is sent to the device after a successful Paging of the device and set-up of an RRC bearer.

How is an application message or firmware/software update configured?

In order to configure individual application messages or firmware/software updates, you must step through three configuration pages, per message. This process is referred to as the "message creation flow," and is initiated by selecting the "Add new message" button above the "Communication Activity" table:

- Payload & IoT Protocols
- Transport & IP Protocols
- Tariff & Data Events

It is possible to revert to the cancel out of the configuration of a message by selecting "Back." This returns you to the "Communication Activity" table. Only after at least one

message has been successfully configured, can a user advance to the next step in the project creation flow. Messages that are in edit mode (either because a user aborted the process by clicking elsewhere in the service wizard, or because the selected “Back” to exit the configuration of a message) are not considered in the calculation of battery life.

After configuring a message, why do I return to the “Communication Activity” page?

The “Communication Activity” page allows you to define individual messages, be it application messages or FOTA/SOTA updates. Once you complete the message creation flow of a message, you return to the “Communication Activity” page to find your message entered in the message table. Only after the successful completion of a message can users press “Next” to advance to the next step in the project creation flow. Alternatively, you may add new messages in the “Communication Activity” configuration page by selecting the corresponding button above the message table.

6.9.1. Payload & IoT Protocols

Where are clouds, IoT/messaging/management protocols, and payload configured?

The new release of the IoT Solution Optimizer reduces the complexity of the project creation flow by combining multiple steps into the same webform. The first configuration page of the message creation flow is divided into two sections: “Payload & IoT Protocol” and “Configure Reporting Events.” This is where you define the cloud service (public cloud, MNO cloud, etc.), IoT protocol (oneM2M, the messaging/management protocol (CoAP, MQTT, MQTT-SN, HTTP), and the transmitted/received payloads.

How do you assign a name to a message?

The “Payload & IoT Protocol” section allows you to assign a dedicated name to the message you want to configure. This is the identifier that appears in the “Communication Activity” table. You can always edit this name afterwards.

How can I configure new messages as device management updates (FOTA/SOTA)?

Please use the toggle switch at the top of the message creation flow’s “Payload & IoT Protocol” section to specify if the transacted data is an application message or a firmware/software update.

Why can I sometimes only configure SOTA updates and not FOTA updates?

This situation is likely caused by the fact that the wireless communication chipset or module you selected does not support Firmware over-the-Air updates. In such cases, the IoT Solution Optimizer offers instead the option to configure application updates for the IoT application, hosted in the microcontroller (MCU). The UI in this case replaces the “Firmware

Update" (FOTA) option with "Software Updates" (SOTA). Please note that you may model SOTA updates also as larger application messages that are invariably sent.

How is the "Payload & IoT Protocol" section in the message creation flow configured?

After defining the name and type of message (application message or FOTA/SOTA update), there are three steps that allow you to configure the application message:

- Step 1: Define the cloud platform via a drop-down.
- Step 2: Select the IoT or service enablement protocol via a drop-down.
- Step 3: Elect a messaging protocol via a drop-down.

It is necessary to select an item from each of these drop downs in order to proceed to the next step in the message creation flow. Failure to configure any of the three drop-down fields will result in an error prompt.

Why are some protocols missing when I select a cloud?

Depending on the cloud you select, there may not be support for specific messaging/management or IoT protocols. We hide those options that do not match your cloud choice.

Why do some protocols have an asterisk next to their name?

Depending on the module or chipset you select, there may not be native support for specific messaging/management or IoT protocols. We place an asterisk next to the protocol name, as well as notification text further below to advise you that you would need to implement a separate protocol stack on your microcontroller (MCU).

How does the "Configure Reporting Events" section work?

In the lower part of the first page of the message creation flow, there is a section called "Configure Reporting Events." In this area, there is a template allowing users to assemble the payload and overhead exchange between device and IoT server that corresponds the general behavior of the application message in question. This is done as follows:

- Please drag-and-drop uplink (dark blue) and downlink (light blue) application payload "boxes" from the left of the page into the Bytes vs. Time chart. Note that the IoT Solution Optimizer will also add the messaging/management protocol and IoT protocol configured in the "Payload & IoT Protocol" section of the page, above.
- Messages can be deleted by simply clicking on the box once placed in the Bytes vs. Time chart; in the colored pop-up dialog box that appears, please choose "Delete."
- Messages can be sized by simply left-clicking on each blue box and entering a value in the grey-colored pop-up dialog box. By hitting "Save," you can apply changes to each individual message. Group changes are not possible for blue payload boxes.

What do the blue boxes represent? How do you place payload into the chart?

The dark blue and light blue boxes in the left-hand side of the page represent application payloads (application data) that you may send from the device to the IoT server (uplink data, dark blue) or from the IoT server to the device (downlink data, light blue). For example, if a temperature sensor sends a 50 Byte message to server to notify about a temperature change, and the server response with a 20 Byte confirmation, you would represent this as a dark blue box of 50 Bytes, followed by a light blue box of 20 Bytes. Simply drag-and-drop the blue boxes from the left-hand panel into the Bytes vs. Time chart on the right. This is done by selecting the appropriate box with the mouse, click and holding the left mouse button, and dragging over into the chart, where you release the left mouse button.

How do I interpret the Bytes vs. Time chart?

The y-axis of the graphic quantifies the amount of payload in Bytes of each message. In order to simplify the view, payloads are not proportionately shown here on the x-axis according their individual transmission times. That said, the details of payload transmission duration are well-accounted for in the separate cloud-based calculation model.

What are the colored boxes that appear below the blue application boxes?

The IoT Solution Optimizer assembles a graphical representation of the IoT and messaging/management protocol you chose earlier in the drop-down selections above the Bytes vs. Time chart. By toggling the protocols above, the IoT Solution Optimizer will redraw the protocol dynamically.

What is the maximum size of any uplink or downlink payload?

The IoT Solution Optimizer currently limits each transmission to/from the IoT device to the Maximum Transmission Unit (MTU) size of the chipset or module, in Bytes. Larger messages must be broken up into multiple uplink or downlink transactions, each maximally the MTU size, in Bytes. A warning message is presented whenever this limit is exceeded by either the application payload, or after adding transport and/or messaging/management protocol overhead on top.

Can I edit multiple uplink and downlink messages at the same time?

Group selection or changes to payload messages is not supported; the desired action must be done for each individual uplink and downlink message separately.

Can I quickly reorder uplink and downlink messages placed in the Bytes vs. Time chart?

It is not possible to re-order the payloads once placed in the Bytes vs. Time chart. Please delete any incorrect messages and reassemble the handshake in the correct sequence it transpires, advancing in time from left to right.

Why do warning messages occasionally display in “Communication Activity” screens?

Warning messages may appear in light orange-colored boxes in case that the selected approach may not be advisable to use with an underlying 3GPP™ NB-IoT bearer. You may study the “Technology Cards” for more insights. Convenient tips are furthermore provided under the links titled, “Which transport protocol do I need?” and “Which IoT Protocol do I need?”

Why am I always getting an error when selecting oneM2M?

oneM2M is an operations-based protocol, like LwM2M. The IoT Solution Optimizer requires you to specify the requested operation to be used for each payload message; these are green request boxes labeled in the chart with the tag “oneM2M”. You can separately adjust the green response boxes labeled “RSP” in the chart. Both procedures are handled by left clicking on the appropriate box.

How do I assign a oneM2M operator to each request message?

When using oneM2M protocol in the IoT Solution Optimizer, it is mandatory to assign a oneM2M operation to each request message. This can be done by left clicking on each green box labeled “oneM2M” found below each light blue or dark blue payload box. You can select the operation type in the grey pop-up dialog box that appears.

Why is there a toggle switch for oneM2M messages when using MQTT?

The oneM2M standard defines different syntax when using JSON or XML format messages with MQTT. By setting the toggle switch properly, you will adjust the default value of the oneM2M protocol. You may left click on the green boxes to match the number of Bytes you will send. The IoT Solution Optimizer proposes reference values that are typical.

Why are Non-IP Data Delivery and MQTT-SN never offered with oneM2M?

The ETSI oneM2M standard is not defined to be used in conjunction with Non-IP Data Delivery (NIDD) or MQTT-SN.

Why are only some protocols offered in the “Communication Activity” screens?

Based on the relationship tree illustrated in Figure 2, you are presented with different possible combinations of transport bearers to add below the IoT or messaging/management protocol you chose. Other combinations are not technically possible. One can opt to go for a more lean, Mobile IoT-friendly packaging of the data (for example, MQTT-SN over Non-IP Data Delivery), or for the heaviest, most inefficient solutions (such as HTTP, over TCP/IPv6). Oftentimes, the cloud you select will predetermine what is available for you to use.

6.9.2. Transport & IP Protocols

Why are transport protocol options hidden from view?

You can select TCP/IPv4, TCP/IPv6, UDP/IPv4, UDP/IPv6, Non-IP Data Delivery from the first drop-down on the "Transport & IP Protocol" configuration area of the message creation flow. Depending on what the network supports, what the chipset or module you selected supports, and what is compatible with the cloud and/or messaging/management protocol selected in the previous page, the IoT Solution Optimizer may hide some of these options from view.

What are "keep alive" messages used for?

Transport Control Protocol (TCP) allows for a session-based communication. Sessions must be started between peers, maintained, and eventually terminated. As network NAT proxy or firewalls do not allow inactive data sessions to remain active over longer periods of time, they may teardown the TCP pipe in-between without either of the peers being aware. This unfortunate situation may even lead to exception scenarios where improperly designed IoT devices are unable to recover the data communication, or a device reboot is required.

TCP "keep alive" messages are available to prevent the premature tear-down of an active TCP session by NAT proxies or firewalls. When setting up a TCP connection, timers related to the "keep alive" procedure are negotiated. When the respective timer reaches zero, the TCP client sends its peer a "keep alive" probe packet with no payload data within it; TCP permits the handling of zero-length data packets. Additionally, the acknowledgement ACK flag is also enabled in the probe packet. The remote host will also reply with no data with an ACK set. Once the reply to the "keep alive" probe is received back at the client, it has essentially confirmed that the connection-based data pipe is still available for application traffic to the host. The same "keep alive" probe resets the network-side firewall timer to avoid premature disconnection.

Do I need to configure "keep alive" messages?

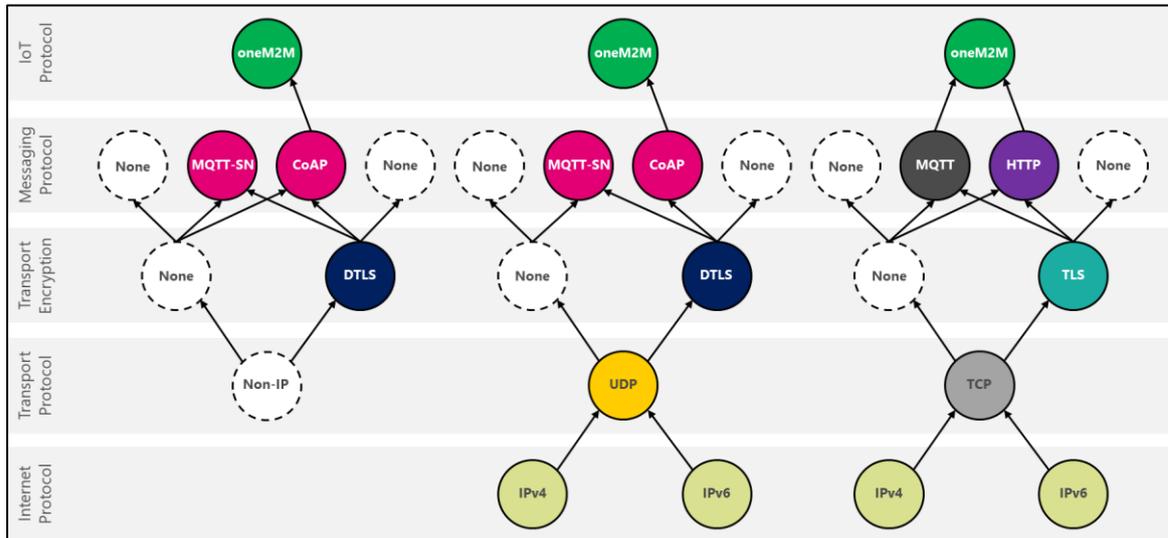
Depending on the cloud connector, network, and/or remote host endpoint configuration, "keep alive" probe packets may need to be sent every few minutes. This has a considerable impact on the battery life of the IoT device; hence, it is strongly discouraged to use this feature for Mobile IoT technologies such as NB-IoT and LTE-M, unless absolutely necessary. Connectionless protocols such as CoAP and MQTT-SN generally do not require TCP "keep alive" messages. Please consult your cloud provider and Mobile Network Operator for more guidance.

Why can't I select transport encryption in the "Transport & Internet Protocol" screen?

Support for Transport Layer Security (TLS), Datagram Transport Layer Security (DTLS) and HTTP Secure (HTTPS) modeling is planned for deployment in the Service Version 3.1, Drop

2. Until then, this option is shown to point out to users that security encryption is not accounted for in the performance analysis. This upcoming feature will give users very insightful assessments of the impact of encryption and how to optimize on account of it.

Figure 2: Relationship Tree of M2M/IoT Protocols



6.9.3. Tariff & Data Events

How can I select a tariff?

At the top of the "Tariff & Data Events" page you will find a list of available tariffs for your tariff country (refer to the "Mobile Network Operator" page in the project configuration flow)

Why are there limits on the number of times I can transmit messages on a mobile network?

Technologies such as NarrowBand IoT (NB-IoT) and LTE-M are not suitable for real-time and streaming services. They are also not intended to be used as the "cheapest" bit pipe option for connecting typical 2G/3G/LTE applications. Failing to adapt IoT application behavior to the paradigm of NB-IoT and LTE-M may not only prematurely drain a battery in an IoT device, but it may congest or damage the MNO's network. A few devices transmitting large payloads every minute, in close proximity to each other, may congest a cell, taking service away from other paying customers. In order to avoid damage to MNO networks, the IoT Solution Optimizer compares the proposed IoT application traffic (application messaging data, plus protocol overhead) to market-specific rules bound to your selected tariff network. These limits determine the maximum allowed monthly data volume and the maximum number of events per day on the selected tariff network, whereby one "event" is considered to be the IoT application traffic configured in the "Communication Activity" node.

Depending on the tariffs that are integrated into the IoT Solution Optimizer, you may be able to select a larger tariff to send more data. A notification message is presented further below in a yellow dialog box.

What can I do in case that I want to transmit more?

Depending on the tariffs that are integrated into the IoT Solution Optimizer, you may be able to select a larger tariff to send more data. A notification message is presented further below in a yellow dialog box.

If you have exhausted your tariff options and still need to send more data, kindly refer to the integrated "Technology Card" on this page which gives insights as to what can be done. You may elect to return to the previous screens to choose more efficient protocols, such as CoAP or MQTT-SN, or use modems with larger MTU sizes to accommodate less transmissions. As a last result, you may need to use a higher-bandwidth technology such as LTE-M instead of NarrowBand IoT. It is important to note that the IoT Solution Optimizer is currently designed to cater to the growing Mobile IoT segment of M2M/IoT business.

6.10. Power Saving Features

Why is the page not available to configure power saving features for my project?

This option is only available for your project if you decided to build a custom-defined design. Products that are selected off the virtual product shelf cannot be customized.

How should I configure the power saving features for my project?

The IoT Solution Optimizer proposes an initial configuration of power saving features based on whether your configured use case is uplink-centric or downlink-centric. Before modifying the proposed configuration of the power saving features, please learn more about them by using the "Technology Cards" embedded in the page. Information is given about the functionality of each feature and how it is used.

Why are several power saving features disabled or enabled when I load this page?

It is critical to note that power saving features must be applied according to the specific IoT application use-case. Activating more is certainly not better, as some feature can lead in specific cases to a waste of battery life, or even a failing product design. When initially loading the "Power Saving Features" page, the IoT Solution Optimizer proposes an initial configuration of power saving features based on whether your configured use case is uplink-centric or downlink-centric. In the case of the latter, further differentiation is made between IoT applications that infrequently communicate – meaning they can leverage Enhanced Discontinuous Reception, versus those that communicate more frequently, and therefore should not use it.

Why are some configuration fields for power saving features greyed-out?

Whenever power saving feature timers and settings are greyed-out on the right-hand side of the page, it indicates that the overriding of such network-side defaults for the selected tariff network is not possible currently. Please note that updating of these mobile network operator network capabilities in the IoT Solution Optimizer is independent of its service releases. That means that once a network allows IoT application overriding of default settings, greyed-out fields are made configurable, independent of any regularly scheduled updates.

Why is the Connected Mode DRX power saving feature always greyed-out?

Usage of Connected Mode Enhanced Discontinuous Reception (cDRX) is not configurable on the IoT device side. As per 3GPP™, the chipset or module will respect the configuration setting of the network. Hence, if the network support cDRX, and it is activated, the IoT device will use it to save power during Connected Mode. More information is available in the "Technology Cards."

6.11. Project Configuration Summary

Where can I find my "Project Summary Report"?

The "Project Summary Report" is generated once the end of the Service Wizard's project configuration flow is reached. Once created, you can always return to it by viewing the project files under "My Projects."

What happened to the Analyze and Optimize Mode screens in Service Version 1.0?

To improve the usability of the IoT Solution Optimizer, Service Version 2.0 presents all analysis and optimization options collectively in a "Project Summary Report" upon completion of the Service Wizard project configuration flow. Please scroll through this report to view all available analysis and optimization options.

The new "Project Summary Report" consists of the following sections:

- Chapter 1: Project Configuration Summary (former "Project Configuration Summary")
- Chapter 2: Project Analysis (former "Analyze")
- Chapter 3: Project Optimization Recommendations (former "Optimize")

Why doesn't the "Project Configuration Summary" always contain the same details about hardware and software configurations?

Depending on the type of hardware product that was configured, the details of this report will vary. If a pre-configured IoT device was selected in the "Product Shelf" screen, the

hardware and software components used within that solution are not displayed. The IoT Solution Optimizer is implemented in this way in order to avoid revealing details of a supplier's proprietary product implementation. Alternatively, if you had decided to design your own custom product, a full inventory of the configured hardware and application features is displayed in the report.

If I want to change the configuration of my project, what's the fastest way to do it?

At the top of the "Project Summary Report," you will find "Edit Project" button. By clicking on this option, you can jump back to beginning of your project to make changes on any screen. Please select the Service Wizard node at the top to jump to specific parts of the the project configuration flow. The IoT Solution Optimizer runs a plausibility check to ensure that no conflicts arise from your changes. For example, by changing the wireless communication chipset or module, you may no longer have hardware support for Non-IP Data Delivery (NIDD); as such, if you have chosen to use Non-IP instead of TCP/IP or UDP/IP, a conflict would occur. The IoT Solution Optimizer warns you regarding which screens you need to consequently change in your configuration.

What does the small SIM card icon next to the flag mean?

The small SIM card icon indicates which mobile network operator you have chosen for your connectivity service tariff. Please note that currently, only one mobile network operator is supported per country. This means that we correlate the country's flag to that operator and their tariff rules.

Can I print the "Project Summary Report"?

From Service Version 2.0, onward, this is possible. There is "Print Report" option now integrated at the top of the "Project Summary Report" page.

Why is a disclaimer shown before I can access my results?

The IoT Solution Optimizer's modeling of your design's performance and suitability is only an approximation. The results given by the service are not intended to be used as the sole input for your product development activities. Please consult your component suppliers for more detailed guidance. Multiple product design and deployment aspects may not be accounted for in the simulation. Such elements may lead to a serious degradation of the expected battery life. Furthermore, the use of a custom battery may contribute an additional deviation, as temperature, architecture, production and chemistry aspects cannot be captured properly with this approximation. At the end, the value presented is a "ball-park" figure. A potential deviation is drawn for you on the chart.

If the results are anyhow approximations, what is the benefit?

Consider the millions of dollars spent every year by companies in the development and refinement of products for the price-sensitive Low Power Wide Area M2M/loT market. Having a service that approximates battery life rather accurately can help drive down significant assessment cost and risks and improve time-to-market by avoiding common mistakes. A company may invest many man-months and tens of thousands of dollars to determine that an M2M/loT product's battery life will not exceed 4.5 years on average. With the IoT Solution Optimizer, a related analysis may deliver a prognostication of 4.8 years to the same company, within minutes. Indeed, there is an appreciable delta in battery life, but companies under time and financial pressure appreciate having an opportunity to get a rough figure or "north star" to guide their development and investments. Use this platform to learn about your customization options, to weigh-out the pros and cons of using specific 3GPP™ features, or to get in contact with world-class suppliers who want to help. At the end, we want to enable your business by winning with partners.

6.12. Project Analysis

What are the results shown in the "Power Consumption Analysis" based on?

After certifying wireless communication chipsets and modules, we spend approximately three days to characterize their power consumption performance on mobile network operator networks, in different radio conditions. To be as accurate as possible, we perform testing in conservative environments, meaning, near the edge of coverage in each Coverage Enhancement Level. The reference channel conditions (RSRP and SINR values) under which performance measurements for the selected wireless communication chipset or module were taken are shown under each Analyze and Optimize visualization.

How do I interpret the "Power Consumption Analysis" bar chart?

The first page of the Analyze Module consists of a "Power Consumption Analysis" bar chart. Here, you can see the prognosticated battery life of the product for a 100% deployment in each Coverage Enhancement (CE) level (i.e., coverage environment), as well as for the composite deployment based in the inputs you had entered in the "Coverage and Mobility" page. By hovering the cursor over each bar, you can see the expected battery life of the device in each scenario displayed in a pop-up window.

How do I interpret the Analyze "Power Consumption Analysis" pie charts?

If available, the Analyze Module "Power Consumption Analysis" pie charts can be used to start identifying potential areas where power consumption can be saved. The IoT Solution Optimizer generates two sets of pie charts:

- **“Composite Power Consumption”** shows the percentage of power consumption due to hardware elements (MCU, GNSS, LDO, DC/DC, antenna, etc.) vs. the percentage of power consumption due to communication activity (module, MNO network configurations, power saving features, application communication, FOTA/SOTA updates).
- **“Communication Power Consumption”** shows the individual power consumption contributions due to specific parts of communication activity (Initialization and Idle Mode procedures or Connected Mode procedures, including power saving features and application data transmission and reception).

You can toggle between the two sets of pie charts by selecting the corresponding name from the drop-down on the upper right corner of the chart.

As seen in the graphics, each application and hardware element’s contribution to the overall power drain varies as function of the Coverage Enhancement (CE) level (coverage environment). By selecting the different element labels below the main pie chart, you can magnify the corresponding pie slice in the circle above and read the percentage contribution in a pop-up window. Likewise, you can interactively select the different pie charts to the right to study in detail how the power contribution of each application and hardware element changes from one CE-Level to the next. Like the previous “Power Consumption Analysis” chart, the different circles here represent how products staying only in that coverage environment would behave. The composite circle shows what the final product’s performance is, based on the percentage allocations previously made in the “Coverage and Mobility” page. Please note that these pie charts are also not drawn to scale with each other.

Why are “Power Consumption Analysis” pie charts not shown sometimes?

The pie charts detailing where power consumption is happening are only available when you choose to design your own custom product, under the “Product Shelf” page. They are not available for pre-configured hardware that is selected off the IoT Solution Optimizer’s product shelves. We implemented the service in this way to avoid revealing details of a supplier’s proprietary product implementation.

Can I do a side-by-side comparison of two projects I created?

Currently, this feature is not supported in the IoT Solution Optimizer; however, it is under consideration to be part of an upcoming service release.

Can I change the colors in my Analyze graphs?

Currently, this feature is not supported in the IoT Solution Optimizer. In order to comply with usability requirements for the visibility-impaired, we use colors with greater contrast to allow easier identification of the pie chart slices. In case that you are not sure what

category a pie slice belongs to, simply hover your cursor over the categories below until the pie slice in question is magnified.

6.13. Project Optimization Recommendations

Sometimes I only see the “Application Reporting Period” Chart. What is happening?

In its current version, the Optimize Module consists of the following pages:

- [\[Custom design\]](#) “Hardware Average Power Consumption” Chart – Impact of the MCU, sensor/actuator average power consumption on battery lifetime
- “Application Reporting Period” Chart – Impact of the application reporting interval on battery lifetime
- [\[Custom design\]](#) “PSM Activity Timer” Chart – Impact of T3324 timer optimization on battery lifetime
- [\[Custom design\]](#) “Enhanced DRX Configuration” Chart – Impact of eDRX feature optimization on battery lifetime
- [\[Custom design\]](#) “Data Payload” Chart – Impact of data payload size on battery lifetime

As seen in the list above, only one optimization chart will be provided if you chose to use a pre-configured hardware found in the product shelf. The IoT Solution Optimizer is implemented in this way in order to avoid revealing details of a supplier’s proprietary product implementation. Furthermore, standardized offerings cannot be customized often by changing application properties or hardware components. Please contact the respective device supplier to learn more.

There is an optimization that I need to do. Can I just click somewhere to apply the change?

Currently, this feature is not supported in the IoT Solution Optimizer. It will be part of the Service Version 2.0 release. Please select the “Edit Project” button on the top of the page to revert to the Service Wizard project configuration flow.

Can I zoom into an Optimization chart?

All charts in the Optimize module are interactive, and you can zoom into the chart by using Window OS’s screen zoom options. In order to make the graphs as informative as possible, we have implemented rules in their graph generation algorithm to scale the graphs as best as possible.

Is there a way to change the graphic x- or y-axis units (e.g. from hours to days)?

Currently, this feature is not supported in the IoT Solution Optimizer.

Why does the battery life of my project get prematurely “cut-off” at a y-axis value of 15 years?

Due to the rapid decay of battery chemical composition, the accuracy of the IoT Solution Optimizer’s calculation is reduced above 15 years. If you require ultra-long operation of your IoT device, please contact your battery supplier for more information. Our Tool Support team can advise on how to contact the experts at Saft S.A., one of the world’s foremost battery manufacturers for Low Power Wide Area IoT applications.

Why do “keep alive” messages produce “saw-tooth” waves in my output charts?

“Keep alive” messages interrupt power saving features and require the set-up of a radio resource bearer between device and network, followed by a brief transmission of data and reception of the ACK acknowledgement. All of this results in a power consumption loss that repeats at intervals defined by the “keep alive” timer. As a result, the optimization graphics in the Project Summary Report Chapter 3 will display “saw-tooth” waveforms, in particular the “Application Reporting Period” graphic.

Transmitted application messages and/or FOTA/SOTA updates reset the “keep alive” timer. If the timer however triggers in-between regular message transmissions, the device must consume additional power just to send the “keep alive” probe packet and receive the ACK. This reduces the power consumption “efficiency” of the device, resulting in a drop in the “Application Reporting Period” curve. Only as you increase the interval between application messages and/or FOTA/SOTA updates, is the device recover enough energy to return to the original battery life of the product before the “keep alive” timer expired. The same jagged drop will repeat at the interval of the “keep alive” timer until the effect become negligible due to other, overriding factors.

Why does the “PSM Activity Timer” graph not appear sometimes?

This screen is only shown if you activated the Power Saving Mode feature for your project, found in the “Power Saving Features” page.

Is it recommended to set the PSM Activity Timer to a value near zero?

As per 3GPP™, the minimum value of the T3324 timer is 2 seconds. That said, due to the latencies and round-trip times that may be experienced with Low Power Wide Area technologies such as NarrowBand IoT, it is not recommended to set the PSM Activity Timer to values below 10 seconds. The risk exists that the server may revert with a message or acknowledgement to the IoT device, which cannot be received in consequence, as the wireless chipset or module inside prematurely entered Deep Sleep Mode. For more information, please review the “Technology Cards” covering 3GPP™ Power Saving Features.

Why does the “Enhanced DRX Configuration” graph not appear sometimes?

This screen is only shown if you activated the Enhanced Discontinuous Reception feature for your project, found in the “Power Saving Features” page.

Why is the “Data Payload” graph usually flat?

Experience shows that modifying payload size to make is as tightly packed as possible brings minimal return on investment. Battery life is only marginally improved by reducing the application message size. At most, benefits can be measured in better coverage conditions (Coverage Enhancement Level 0). That said, it is important to communicate in Mobile IoT use cases as efficiently as possible. Every inefficiency in your design is one reason more why it may not be fit for its intended purpose.

Is there any other way to improve performance in Coverage Enhancement Level 2?

The IoT Solution Optimizer helps enterprises appreciate how challenging a Deep Indoor deployment can be. In case that the optimization charts do not provide a clear lead for significantly improving your battery life, please try to select a larger battery. Although less cost-effective, this will usually do the trick.

6.14. AT Command Guide

Why is an “AT Command Guide” not generated for my project?

Very likely this is due to the selection of a pre-integrated solution on the IoT Solution Optimizer’s virtual product shelf. These products are intentionally implemented in a way that avoids revealing details of a supplier’s proprietary product implementation. Since there is usually no AT command interface to access for the sake of modifying the product’s behavior, there is no need to generate such a guide. In case that you do have special needs for the deployment of your product, please contact the supplier. Their contact information is found on the product specification documentation, which can be downloaded with the “More Info” button found next to the product picture and description, in the “Product Shelf” page.

If you indeed decided to design your own custom product, an “AT Command Guide” is generated for your project and should be found in the respective project folder under “My Projects.”

Why are AT commands missing in the guide?

We map the supported list of AT commands of each wireless communication chipset and module to project configurations. An AT command is only displayed in the guide for a specific feature if the wireless communication chipset or module you selected supports it,

and if you decided to use that feature in the project. We avoid presenting information that is not relevant for your project. By changing the hardware used in your custom project, as well as its feature configuration, you will note that the AT command list in the guide adapts accordingly. As time passes, suppliers may remove or add feature support. We try our best to manage the integrated AT command library so that it reflects the latest supplier offering.

Does the “AT Command Guide” give me code or scripts that I can copy-paste into my application?

No. The intent of the “AT Command Guide” is to serve as a simplified “checklist” of all essential features that should be activated on the wireless communication module or chipset, based on your IoT Solution Optimizer design inputs. The “AT Command Guide” is not meant to generate script that can be taken directly into use. It also does not replace the supplier’s own AT command documentation. We only show a very small subset of their proprietary AT commands; there may be many more that are very relevant for your use case and implementation. Please contact the supplier for their official documentation and technical support.

6.15. Localized Onboarding Card

I have selected multiple countries. Why don’t I get an onboarding card for each market?

The IoT Solution Optimizer generates either a web-link or PDF onboarding card based on the tariff country and corresponding mobile network operator (MNO) defined in your project. The document may contain marketing information, contacts, links to online resources, and/or special offers which may be updated from time-to-time.

The onboarding card is in a language I do not understand. What should I do?

We localize the onboarding card of each market to ensure that customers in those countries can have a more personalized experience. Each integrated mobile network operator generally has a contact e-mail, business address, or phone number in their webpage or document. Please reach out the mobile network operator for more information on the offer. They will be glad to support your needs.

I created a project last week. Where can I find its onboarding card again?

The onboarding cards are part of the project documentation stored in the “My Projects” page. By opening any project folder therein, you will find all project-specific documents such as the Project Summary Report, your onboarding card, and an “AT Command Guide.” The latter is only available if you defined your own custom hardware and application configuration.

For how long are the commercial offers in the onboarding cards valid?

The onboarding cards are regularly updated by the IoT Solution Optimizer administration team. Whenever you return to your "My Projects" page, and select an onboarding card, the service either loads the most recent webpage in a new browser tab or downloads the latest PDF version from the database. As such, please store any onboarding document which you may want to keep for your records locally on your computer. As this content comes directly from the selected, third-party mobile network operator, the IoT Solution Optimizer service owner is not liable for any information therein which may be inaccurate, outdated or inconsistent.

7. Pop-up Cards

7.1. Technology Cards

What are "Technology Cards?"

Throughout the user interface of the IoT Solution Optimizer, it is possible to find dozens of underlined, colored words and phrases. These are active links that open overlaid wiki screens referred to as "Technology Cards". By having an in-built wiki-engine, the IoT Solution Optimizer allows users of all backgrounds to better understand the various technologies and content presented by the service. Numerous screens provide guidance on best-practice design choices, as well as explaining limitations which may occur during the configuration of projects. Occasionally, the "Technology Cards" contain hyperlinks to external webpages, or videos, as well as embedded pictures and documents.

How can I close the "Technology Cards" that are displayed?

In order to return to the service's user interface, you can simply click the darkened user interface in the background. This action closes the active "Technology Card" and you can see the area of the webpage previously covered by it. Alternatively, you can click the "x" icon at the top right-hand corner of the card.

How can I navigate through "Technology Cards?"

Within each "Technology Card" additional links may appear; by selecting any of these, a new card opens and replaces the previous one. You can use this feature to seamlessly navigate forward from one topic to another, discovering the numerous interdependencies between design options features and their impact on your hardware and software implementation.

How can I go back to a previous “Technology Card” that I saw?

It is important to note that for the sake of simplicity, no “Back” button has been implemented; instead, you can return to a wiki topic by either retracing your path, or by navigating forward through the embedded links to the same card, wherever possible.

Which “Technology Cards” are currently available in the IoT Solution Optimizer?

The “Technology Cards” feature in Service Version 2.0 covers well over 100 topics related to Mobile IoT product design and optimization. Topics are organized broadly into the following categories:

- IoT Basics – Machine to Machine, Internet of Things, oneM2M
- IoT Vertical Industries – Characteristics of IoT application verticals
- IoT Device Hardware Components – Building blocks of IoT devices
- Power Supplies – Fundamentals of battery technology
- IoT Security Overview – Encryption Protocols
- Access Technologies – WAN: 3GPP™ Mobile IoT radio access technologies
- Power Saving Features – 3GPP™ Mobile IoT features for power optimization
- Service Enablement – Device Management
- IoT Application – IP, Transport, Messaging/Management, Connection Efficiency
- MNO Offerings – Service Provider Service Differentiations
- Certifications – International, Regional

Please note that the integration of new “Technology Cards” to the IoT Solution Optimizer is independent of its service releases. That means that additional wiki entries may become available independently of regularly scheduled service releases.

Is there a place where I can access all of the “Technology Cards” in a library view?

Users with access to the breadcrumb “IoT Services” have the option to view the “Technology Cards” in a wiki called the “Learn;” this is a separate experience from the IoT Solution Optimizer service described in this FAQ document.

7.2. Service Provider-specific Overlay Cards

Why do service provider-specific overlay cards invariably appear in the IoT Solution Optimizer screens?

Service provider-specific cards serve as an advertisement of the technology- and service-differentiations that specific IoT Solution Optimizer ecosystem partners offer their IoT customers. Depending on your account configuration, the IoT Solution Optimizer will periodically display these overlaid screens.

How can I close the service provider-specific cards that are displayed?

In order to return to the service's user interface, you can simply click the darkened user interface in the background. This action closes the active "Benefit of Telekom" card and you can see the area of the webpage previously covered by it. Alternatively, you can click the "x" icon at the top right-hand corner of the card.

How often are service provider-specific cards shown in the IoT Solution Optimizer?

Service provider-specific cards are different from "Technology Cards" in that they appear only once per quarter (90 days). This is implemented via an account-specific timer running in the background. Please note that if the IoT Solution Optimizer administrators change the content of any card, the user-specific timer is reset, and the card will be subsequently shown.

Which service provider-specific cards are currently available in the IoT Solution Optimizer?

The service provider-specific cards may appear in the following screens:

- "Mobile Operator Network" Page
- "Access Technology" Page
- "IoT Vertical" Page
- "Data Events" Page
- "Coverage & Mobility" Page

Their content is defined by the IoT Solution Optimizer partner, as well as the frequency that they are displayed, if at all.

8. Service Version 3.1 Update (Drops 3.1.1 and 3.1.2)

When will Service Version 3.1.1 be released?

During late Q4, 2020, the IoT Service Version 3.1 (Drop 1) is slated to be released. For updates, please select the tick box under "My Account" to receive regular e-mail notifications.

What will Service Version 3.1.1 include?

This service update is planned to integrate many new compelling features including:

- Antenna component shelf and antenna placement modeling (impact to coverage and battery life)
- GNSS component shelf and configurator for operating modes (Default, Host CPU Tracing, Continuous Tracing, Automatic Tracing)

- Optional: eCommerce integration to 3rd party webshops

When will Service Version 3.1.2 be released?

During early Q1, 2019, the IoT Service Version 3.1.2 (Drop 2) is slated to be released. For updates, please select the tick box under “My Account” to receive regular e-mail notifications.

What will Service Version 3.1.2 include?

This service update is planned to integrate many new compelling features including:

- 3GPP™ LTE-M Radio Access Technology (RAT) modeling
- Different network configurations within an operator country footprint
- Roaming partner filtering for network selection
- Impact of TLS/DTLS/HTTPS security

Can I propose new features or requirements for Service Version 3.1 (Drops 1 & 2)?

The IoT Solution Optimizer team looks forward to supporting enterprises’ needs as accurately and efficiently as possible. Our clear target is to have a “Best-in-World” solution, which can connect businesses globally, 24/7, to the IoT opportunities of today and tomorrow. Please send us your thoughts on how we can make the experience better for you and your business! Just send our administration team a message.