MQTT Comms Handler

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Namespace Documentation

4.1 preprocess Namespace Reference

Functions

- extract_definitions (header_file)
- replace_placeholders (html_file, definitions, dest_file)
- compress_page_as_header (src_path, dest_path)
- html_to_progmem (html_file_path, output_cpp_file, variable_name="html_gz")
- preprocess_webpage (env)

Variables

- str script_dir = "lib/comms_handler/src/configwebpage/webpage"
- src_html_path = os.path.join(script_dir, "websrc.html")
- temp_html_path = os.path.join(script_dir, "prepped.html")
- dest_html_path = os.path.join(script_dir, "webpage.cpp")
- src_header_endpoints = os.path.join(script_dir, "endpoints.h")
- str config_dir = "lib/comms_handler/src/config"
- src_header_keys = os.path.join(config_dir, "configkeys.h")
- str src_dir = "src/"
- src_metadata = os.path.join(src_dir, "metadata.h")

4.1.1 Function Documentation

4.1.1.1 compress_page_as_header()

```
preprocess.compress_page_as_header (
              src_path,
              dest_path)
```

4.1.1.2 extract_definitions()

```
preprocess.extract_definitions (
              header_file)
```

4.1.1.3 html_to_progmem()

```
preprocess.html_to_progmem (
              html_file_path,
              output_cpp_file,
              variable_name = "html_gz")
```

4.1.1.4 preprocess_webpage()

```
preprocess.preprocess_webpage (
              env)
```

4.1.1.5 replace_placeholders()

```
preprocess.replace_placeholders (
              html_file,
              definitions,
              dest_file)
```

4.1.2 Variable Documentation

4.1.2.1 config_dir

```
str preprocess.config_dir = "lib/comms_handler/src/config"
```

4.1.2.2 dest_html_path

```
preprocess.dest_html_path = os.path.join(script_dir, "webpage.cpp")
```

4.1.2.3 script_dir

```
str preprocess.script_dir = "lib/comms_handler/src/configwebpage/webpage"
```

4.1.2.4 src_dir

```
str preprocess.src_dir = "src/"
```

4.1.2.5 src_header_endpoints

```
preprocess.src_header_endpoints = os.path.join(script_dir, "endpoints.h")
```

4.1.2.6 src_header_keys

```
preprocess.src_header_keys = os.path.join(config_dir, "configkeys.h")
```

4.1.2.7 src_html_path

```
preprocess.src_html_path = os.path.join(script_dir, "websrc.html")
```

4.1.2.8 src_metadata

```
preprocess.src_metadata = os.path.join(src_dir, "metadata.h")
```

4.1.2.9 temp_html_path

```
preprocess.temp_html_path = os.path.join(script_dir, "prepped.html")
```

Chapter 5

Class Documentation

5.1 CommsHandler::BlinkPattern_t Struct Reference

```
#include <comms_handler.h>
```

Public Attributes

- int num_blinks
- int times [10]

5.1.1 Member Data Documentation

5.1.1.1 num_blinks

```
int CommsHandler::BlinkPattern_t::num_blinks
```

5.1.1.2 times

```
int CommsHandler::BlinkPattern_t::times[10]
```

The documentation for this struct was generated from the following file:

- lib/comms_handler/src/comms_handler.h

5.2 CommsHandler Class Reference

```
#include <comms_handler.h>
```

Classes

- struct BlinkPattern_t
- struct CommsHandler_MQTTMessage_t

Public Types

- enum CommsHandler_Net_Pref_t { Comms_WiFi_Only , Comms_LTE_Only , Comms_WiFi_over_LTE , Comms_LTE_over_WiFi }
- enum CommsHandler_State_t {
  Comms_Unititialized , Comms_WiFi_Connected_Only , Comms_LTE_Connected_Only , Comms_WiFi_Connected_Primary ,
  Comms_LTE_Connected_Primary , Comms_WiFi_Connected_Secondary , Comms_LTE_Connected_Secondary , Comms_Disconnected }
- enum CommsHandler_Error_t {
  Comms_No_Error , Comms_Error_WiFi , Comms_Error_LTE , Comms_Error_MQTT ,
  Comms_Error_Unknown }

Public Member Functions

- CommsHandler ()
- bool addMQTTMessageToQueue (String topic, String payload, int qos=0)
- bool addMQTTMessageToQueue (String topic, String payload, int qos=0, bool retain=false, bool dup=false)
- bool subscribeToMQTTTopic (String topic, int qos=0)
- bool unsubscribeFromMQTTTopic (String topic)
- bool messageAvailableMQTTTopic (String topic)
- void setIndicatorLEDPattern (int count,...)

Static Public Member Functions

- static void CommsHandlerManagementTask (void ∗pvParameters)
- static void CommsHandlerQueueTask (void ∗pvParameters)
- static void CommsHandlerLTETask (void ∗pvParameters)
- static void CommsHandlerWiFiTask (void ∗pvParameters)
- static void IndicatorLEDPatternTask (void ∗pvParameters)

Private Member Functions

- void _load_current_config ()
- void _lte_power_on ()
- void _lte_power_off ()
- bool _lte_mqtt_init ()
- bool _lte_mqtt_pub (String topic, String payload, int qos, bool retain, bool dup)
- void _lte_mqtt_sub ()
- void _lte_get_state ()
- bool _wifi_power_on ()
- bool _wifi_mqtt_init ()
- bool _wifi_mqtt_pub (String topic, String payload, int qos, bool retain, bool dup)
- void _wifi_mqtt_sub ()
- void _wifi_power_off ()
- void _wifi_get_state ()

Private Attributes

- OTAHelper * _ota_helper
- ConfigHelper * _config_helper
- ConfigWebpage * _config_webpage
- CommsHandler_State_t _state
- CommsHandler_Error_t _error
- CommsHandler_Net_Pref_t _net_preference
- int _net_pref_switch_timeout
- QueueHandle_t _mqtt_msg_queue
- QueueHandle_t _mqtt_msg_current
- QueueHandle_t _led_blink_pattern
- String _mqtt_server
- int _mqtt_port
- String _mqtt_username
- String _mqtt_password
- String _mqtt_client_id
- int _mqtt_keepalive
- bool _mqtt_clean_session
- String _mqtt_lwt_topic
- String _mqtt_lwt_payload
- int _mqtt_lwt_qos
- int _size_mqtt_msg_queue
- String _lte_apn
- String _sta_ssid
- String _sta_pass
- String _ota_json_url
- int _ota_freq_mins
- A76XX * _lte_client = nullptr
- A76XXMQTTClient * _lte_mqtt_client = nullptr
- MQTTClient * _wifi_mqtt_client = nullptr
- WiFiClient * _wifi_client = nullptr

5.2.1 Member Enumeration Documentation

5.2.1.1 CommsHandler_Error_t

```
enum CommsHandler::CommsHandler_Error_t
```

Enumerator

Comms_No_Error	
Comms_Error_WiFi	
Comms_Error_LTE	
Comms_Error_MQTT	
Comms_Error_Unknown	

5.2.1.2 CommsHandler_Net_Pref_t

```
enum CommsHandler::CommsHandler_Net_Pref_t
```

Enumerator

Comms_WiFi_Only	
Comms_LTE_Only	
Comms_WiFi_over_LTE	
Comms_LTE_over_WiFi	

5.2.1.3 CommsHandler_State_t

```
enum CommsHandler::CommsHandler_State_t
```

Enumerator

Comms_Unititialized	
Comms_WiFi_Connected_Only	
Comms_LTE_Connected_Only	
Comms_WiFi_Connected_Primary	
Comms_LTE_Connected_Primary	
Comms_WiFi_Connected_Secondary	
Comms_LTE_Connected_Secondary	
Comms_Disconnected	

5.2.2 Constructor & Destructor Documentation

5.2.2.1 CommsHandler()

```
CommsHandler::CommsHandler ()
```

5.2.3 Member Function Documentation

5.2.3.1 _load_current_config()

```
void CommsHandler::_load_current_config ()  [private]
```

5.2.3.2 _lte_get_state()

```
void CommsHandler::_lte_get_state ()  [private]
```

5.2.3.3 _lte_mqtt_init()

```
bool CommsHandler::_lte_mqtt_init ()  [private]
```

5.2.3.4 _lte_mqtt_pub()

```
bool CommsHandler::_lte_mqtt_pub (
             String topic,
             String payload,
             int qos,
             bool retain,
             bool dup)  [private]
```

5.2.3.5 _lte_mqtt_sub()

```
void CommsHandler::_lte_mqtt_sub ()  [private]
```

5.2.3.6 _lte_power_off()

```
void CommsHandler::_lte_power_off ()  [private]
```

5.2.3.7 _lte_power_on()

```
void CommsHandler::_lte_power_on ()  [private]
```

5.2.3.8 _wifi_get_state()

```
void CommsHandler::_wifi_get_state ()  [private]
```

5.2.3.9 _wifi_mqtt_init()

```
bool CommsHandler::_wifi_mqtt_init ()  [private]
```

5.2.3.10 _wifi_mqtt_pub()

```
bool CommsHandler::_wifi_mqtt_pub (
             String topic,
             String payload,
             int qos,
             bool retain,
             bool dup)  [private]
```

5.2.3.11 _wifi_mqtt_sub()

```
void CommsHandler::_wifi_mqtt_sub ()  [private]
```

5.2.3.12 _wifi_power_off()

```
void CommsHandler::_wifi_power_off ()  [private]
```

5.2.3.13 _wifi_power_on()

```
bool CommsHandler::_wifi_power_on ()  [private]
```

5.2.3.14 addMQTTMessageToQueue() [1/2]

```
bool CommsHandler::addMQTTMessageToQueue (
             String topic,
             String payload,
             int qos = 0)
```

5.2.3.15 addMQTTMessageToQueue() [2/2]

```
bool CommsHandler::addMQTTMessageToQueue (
             String topic,
             String payload,
             int qos = 0,
             bool retain = false,
             bool dup = false)
```

5.2.3.16 CommsHandlerLTETask()

```
void CommsHandler::CommsHandlerLTETask (
             void * pvParameters)  [static]
```

5.2.3.17 CommsHandlerManagementTask()

```
void CommsHandler::CommsHandlerManagementTask (
             void * pvParameters)  [static]
```

5.2.3.18 CommsHandlerQueueTask()

```
void CommsHandler::CommsHandlerQueueTask (
             void * pvParameters)  [static]
```

5.2.3.19 CommsHandlerWiFiTask()

```
void CommsHandler::CommsHandlerWiFiTask (
             void * pvParameters)  [static]
```

5.2.3.20 IndicatorLEDPatternTask()

```
void CommsHandler::IndicatorLEDPatternTask (
             void * pvParameters)  [static]
```

5.2.3.21 messageAvailableMQTTTopic()

```
bool CommsHandler::messageAvailableMQTTopic (
             String topic)
```

5.2.3.22 setIndicatorLEDPattern()

```
void CommsHandler::setIndicatorLEDPattern (
             int count,
              ...)
```

5.2.3.23 subscribeToMQTTTopic()

```
bool CommsHandler::subscribeToMQTTTopic (
             String topic,
             int qos = 0)
```

5.2.3.24 unsubscribeFromMQTTTopic()

```
bool CommsHandler::unsubscribeFromMQTTTopic (
             String topic)
```

5.2.4 Member Data Documentation

5.2.4.1 _config_helper

```
ConfigHelper* CommsHandler::_config_helper  [private]
```

5.2.4.2 _config_webpage

```
ConfigWebpage* CommsHandler::_config_webpage  [private]
```

5.2.4.3 _error

```
CommsHandler_Error_t CommsHandler::_error  [private]
```

5.2.4.4 _led_blink_pattern

```
QueueHandle_t CommsHandler::_led_blink_pattern  [private]
```

5.2.4.5 _lte_apn

```
String CommsHandler::_lte_apn  [private]
```

5.2.4.6 _lte_client

```
A76XX* CommsHandler::_lte_client = nullptr  [private]
```

5.2.4.7 _lte_mqtt_client

```
A76XXMQTTClient* CommsHandler::_lte_mqtt_client = nullptr  [private]
```

5.2.4.8 _mqtt_clean_session

```
bool CommsHandler::_mqtt_clean_session  [private]
```

5.2.4.9 _mqtt_client_id

```
String CommsHandler::_mqtt_client_id  [private]
```

5.2.4.10 _mqtt_keepalive

```
int CommsHandler::_mqtt_keepalive  [private]
```

5.2.4.11 _mqtt_lwt_payload

```
String CommsHandler::_mqtt_lwt_payload  [private]
```

5.2.4.12 _mqtt_lwt_qos

```
int CommsHandler::_mqtt_lwt_qos  [private]
```

5.2.4.13 _mqtt_lwt_topic

```
String CommsHandler::_mqtt_lwt_topic  [private]
```

5.2.4.14 _mqtt_msg_current

```
QueueHandle_t CommsHandler::_mqtt_msg_current  [private]
```

5.2.4.15 _mqtt_msg_queue

```
QueueHandle_t CommsHandler::_mqtt_msg_queue  [private]
```

5.2.4.16 _mqtt_password

String CommsHandler::_mqtt_password [private]

5.2.4.17 _mqtt_port

int CommsHandler::_mqtt_port [private]

5.2.4.18 _mqtt_server

String CommsHandler::_mqtt_server [private]

5.2.4.19 _mqtt_username

String CommsHandler::_mqtt_username [private]

5.2.4.20 _net_pref_switch_timeout

int CommsHandler::_net_pref_switch_timeout [private]

5.2.4.21 _net_preference

CommsHandler_Net_Pref_t CommsHandler::_net_preference [private]

5.2.4.22 _ota_freq_mins

int CommsHandler::_ota_freq_mins [private]

5.2.4.23 _ota_helper

OTAHelper* CommsHandler::_ota_helper [private]

5.2.4.24 _ota_json_url

String CommsHandler::_ota_json_url [private]

5.2.4.25 _size_mqtt_msg_queue

int CommsHandler::_size_mqtt_msg_queue [private]

5.2.4.26 _sta_pass

```
String CommsHandler::_sta_pass  [private]
```

5.2.4.27 _sta_ssid

```
String CommsHandler::_sta_ssid  [private]
```

5.2.4.28 _state

```
CommsHandler_State_t CommsHandler::_state  [private]
```

5.2.4.29 _wifi_client

```
WiFiClient* CommsHandler::_wifi_client = nullptr  [private]
```

5.2.4.30 _wifi_mqtt_client

```
MQTTClient* CommsHandler::_wifi_mqtt_client = nullptr  [private]
```

The documentation for this class was generated from the following files:

- lib/comms_handler/src/comms_handler.h
- lib/comms_handler/src/comms_handler.cpp

5.3 CommsHandler::CommsHandler_MQTTMessage_t Struct Reference

```
#include <comms_handler.h>
```

Public Attributes

- String topic
- String payload
- int qos
- bool retain
- bool dup

5.3.1 Member Data Documentation

5.3.1.1 dup

```
bool CommsHandler::CommsHandler_MQTTMessage_t::dup
```

5.3.1.2 payload

```
String CommsHandler::CommsHandler_MQTTMessage_t::payload
```

5.3.1.3 qos

```
int CommsHandler::CommsHandler_MQTTMessage_t::qos
```

5.3.1.4 retain

```
bool CommsHandler::CommsHandler_MQTTMessage_t::retain
```

5.3.1.5 topic

```
String CommsHandler::CommsHandler_MQTTMessage_t::topic
```

The documentation for this struct was generated from the following file:

- lib/comms_handler/src/comms_handler.h

5.4 ConfigHelper Class Reference

```
#include <confighelper.h>
```

Public Member Functions

- ConfigHelper (bool factoryreset)

  Construct a new Config Helper:: Config Helper object.
- ∼ConfigHelper ()
- String getDeviceMACString ()

  Helper function to get device MAC as a string.
- void restoreDefaultConfigJSON (bool write_to_nvs=false)

  All the default options of the configuration set to the JSON object.
- void loadConfigJSONFromNVS ()

  Load the configuration from NVS to JSON object.
- void saveConfigJSONToNVS ()

  Save the configuration JSON to NVS.
- String getConfigJSONString ()

  Get the JSON string of the configuration.
- int getConfigOption (const char ∗key, int default_value)
- String getConfigOption (const char ∗key, const char ∗default_value)
- bool getConfigOption (const char ∗key, bool default_value)
- float getConfigOption (const char ∗key, float default_value)
- void setConfigOption (const char ∗key, int value, bool write_to_nvs=true)
- void setConfigOption (const char ∗key, const char ∗value, bool write_to_nvs=true)
- void setConfigOption (const char ∗key, bool value, bool write_to_nvs=true)
- void setConfigOption (const char ∗key, float value, bool write_to_nvs=true)

Private Member Functions

- void getConfigOptionNVS (const char ∗key, bool open_namespace=true)

  Writes the value of the key from NVS to the value of the key in the JSON object.
- void setConfigOptionNVS (const char ∗key, bool open_namespace=true)

  Writes the value of the key from the JSON object to the NVS.

Private Attributes

- JsonDocument _config_json
- const char ∗ _config_namespace = "cfg"
- Preferences _preferences

5.4.1 Constructor & Destructor Documentation

5.4.1.1 ConfigHelper()

```
ConfigHelper::ConfigHelper (
            bool factoryreset)
```

Construct a new Config Helper:: Config Helper object.

Parameters

factoryreset	overwrite the current config (if exists) with the default config

5.4.1.2 ∼ConfigHelper()

```
ConfigHelper::∼ConfigHelper ()
```

5.4.2 Member Function Documentation

5.4.2.1 getConfigJSONString()

```
String ConfigHelper::getConfigJSONString ()
```

Get the JSON string of the configuration.

Returns

String

5.4.2.2 getConfigOption() [1/4]

```
bool ConfigHelper::getConfigOption (
            const char ∗ key,
            bool default_value)
```

5.4.2.3 getConfigOption() [2/4]

```
String ConfigHelper::getConfigOption (
             const char * key,
             const char * default_value)
```

5.4.2.4 getConfigOption() [3/4]

```
float ConfigHelper::getConfigOption (
             const char * key,
             float default_value)
```

5.4.2.5 getConfigOption() [4/4]

```
int ConfigHelper::getConfigOption (
             const char * key,
             int default_value)
```

5.4.2.6 getConfigOptionNVS()

```
void ConfigHelper::getConfigOptionNVS (
             const char * key,
             bool open_namespace = true)  [private]
```

Writes the value of the key from NVS to the value of the key in the JSON object.

Parameters

key	the key to get from NVS
open_namespace	flag to open the namespace, set to false if handled externally

5.4.2.7 getDeviceMACString()

```
String ConfigHelper::getDeviceMACString ()
```

Helper function to get device MAC as a string.

String has special characters already removed

Returns

String

5.4.2.8 loadConfigJSONFromNVS()

```
void ConfigHelper::loadConfigJSONFromNVS ()
```

Load the configuration from NVS to JSON object.

5.4.2.9 restoreDefaultConfigJSON()

```
void ConfigHelper::restoreDefaultConfigJSON (
             bool write_to_nvs = false)
```

All the default options of the configuration set to the JSON object.

JSON object is cleared first Formats strings with the Device MAC string where necessary

Parameters

write_to_nvs	

5.4.2.10 saveConfigJSONToNVS()

```
void ConfigHelper::saveConfigJSONToNVS ()
```

Save the configuration JSON to NVS.

5.4.2.11 setConfigOption() [1/4]

```
void ConfigHelper::setConfigOption (
             const char * key,
             bool value,
             bool write_to_nvs = true)
```

5.4.2.12 setConfigOption() [2/4]

```
void ConfigHelper::setConfigOption (
             const char * key,
             const char * value,
             bool write_to_nvs = true)
```

5.4.2.13 setConfigOption() [3/4]

```
void ConfigHelper::setConfigOption (
             const char * key,
             float value,
             bool write_to_nvs = true)
```

5.4.2.14 setConfigOption() [4/4]

```
void ConfigHelper::setConfigOption (
             const char * key,
             int value,
             bool write_to_nvs = true)
```

5.4.2.15 setConfigOptionNVS()

```
void ConfigHelper::setConfigOptionNVS (
             const char * key,
             bool open_namespace = true)  [private]
```

Writes the value of the key from the JSON object to the NVS.

Parameters

key	the key to write to NVS (15 char limit?)
open_namespace	flag to open the namespace, set to false if handled externally

5.4.3 Member Data Documentation

5.4.3.1 _config_json

```
JsonDocument ConfigHelper::_config_json  [private]
```

5.4.3.2 _config_namespace

```
const char* ConfigHelper::_config_namespace = "cfg"  [private]
```

5.4.3.3 _preferences

```
Preferences ConfigHelper::_preferences  [private]
```

The documentation for this class was generated from the following files:

- lib/comms_handler/src/config/confighelper.h
- lib/comms_handler/src/config/confighelper.cpp

5.5 ConfigWebpage Class Reference

```
#include <configwebpage.h>
```

Public Member Functions

- ConfigWebpage (ConfigHelper ∗config_helper=nullptr, OTAHelper ∗ota_helper=nullptr)

  Construct a new Config Webpage:: Config Webpage object.
- void ConfigServeRootPage (AsyncWebServerRequest ∗request)

  Serves the root page from PROGMEM.
- void handleSendCurrentConfigJSON (AsyncWebServerRequest ∗request)

  Sends the current configuration JSON as a string to the webpage.
- void handleReceiveConfigJSON (AsyncWebServerRequest ∗request)

  NOT YET IMPLEMENTED - NOT FUNCTIONAL.
- void handleSendStatusJSON (AsyncWebServerRequest ∗request)

  Sends the current status of the device as a JSON string.
- void handleDeviceSettingsConfig (AsyncWebServerRequest ∗request)

  NOT YET IMPLEMENTED - NOT FUNCTIONAL.
- void handleFactoryReset (AsyncWebServerRequest ∗request)

  Handles factory reset, by calling the appropriate config helper functions.

- void handleDeviceRestart (AsyncWebServerRequest ∗request)

  Restarts device, may result in client disconnection.
- void handleUpdateOTAConfig (AsyncWebServerRequest ∗request)
- void handleUpdateOTAInternet (AsyncWebServerRequest ∗request)
- void handleUpdateOTAFileUpload (AsyncWebServerRequest ∗reques, String filename, size_t index, uint8_t ∗data, size_t len, bool final)

  Handle receiving a file upload for OTA update.
- void handleUpdateOTANowRequest (AsyncWebServerRequest ∗request)

  Immediately check the URL for an OTA update.
- void handleReceiveInternetPreferences (AsyncWebServerRequest ∗request)

  Receive, validate and save internet preferences.
- void handleStationStartScan (AsyncWebServerRequest ∗request)

  Start scanning for WiFi networks asynchronously when called.
- void handleStationScanResults (AsyncWebServerRequest ∗request)

  Sends back the num_networks found and the networks in a JSON array.
- void handleStationSetConfig (AsyncWebServerRequest ∗request)

  Set the station configuration and attempt to connect.
- void handleLTESetConfig (AsyncWebServerRequest ∗request)

  Receive validate and set LTE settings.
- void handleAccessPointSetConfig (AsyncWebServerRequest ∗request)

  Receive, validate and save the access point settings.
- void handleMQTTSetConfig (AsyncWebServerRequest ∗request)

  Receive and validate the data from the MQTT form.

Static Public Member Functions

- static void ConfigServerTask (void ∗pvParameters)

  TaskManager task to handle DNS requests.
- static void handleUpdateOTAStatus (void ∗pvParameters)

  Sends the current status of the OTA update.
- static void handleStationSendUpdate (void ∗pvParameters)

  Attempt to connect to the WiFi network.

Public Attributes

- ConfigHelper ∗ _config_helper
- JsonDocument _update_json
- OTAHelper ∗ _ota_helper
- AsyncWebServer ∗ _server
- AsyncEventSource ∗ _event_source
- DNSServer ∗ _dnsServer
- IPAddress _ap_ip
- IPAddress _net_msk
- const byte _dns_port = 53

Private Attributes

- int _sta_attempts
- String _sta_ssid
- String _sta_pass

5.5.1 Constructor & Destructor Documentation

5.5.1.1 ConfigWebpage()

```
ConfigWebpage::ConfigWebpage (
            ConfigHelper * config_helper = nullptr,
            OTAHelper * ota_helper = nullptr)
```

Construct a new Config Webpage:: Config Webpage object.

Parameters

config_helper	optional argument to pass in a config helper object
ota_helper	optional argument to pass in an ota helper object

If either or both are not passed, new ones will be created

5.5.2 Member Function Documentation

5.5.2.1 ConfigServeRootPage()

```
void ConfigWebpage::ConfigServeRootPage (
            AsyncWebServerRequest * request)
```

Serves the root page from PROGMEM.

This function can also be where authentication is implemented

Parameters

request	

5.5.2.2 ConfigServerTask()

```
void ConfigWebpage::ConfigServerTask (
            void * pvParameters)  [static]
```

TaskManager task to handle DNS requests.

Parameters

pvParameters	

5.5.2.3 handleAccessPointSetConfig()

```
void ConfigWebpage::handleAccessPointSetConfig (
            AsyncWebServerRequest * request)
```

Receive, validate and save the access point settings.

Formats the SSID with the UID if the pattern is found

Parameters

request	

5.5.2.4 handleDeviceRestart()

```
void ConfigWebpage::handleDeviceRestart (
            AsyncWebServerRequest * request)
```

Restarts device, may result in client disconnection.

Parameters

request	

5.5.2.5 handleDeviceSettingsConfig()

```
void ConfigWebpage::handleDeviceSettingsConfig (
            AsyncWebServerRequest * request)
```

NOT YET IMPLEMENTED - NOT FUNCTIONAL.

This function is a placeholder for device settings configuration. The complete version could handle different user accounts, along with device names and other suitable parameters.

Parameters

request	

5.5.2.6 handleFactoryReset()

```
void ConfigWebpage::handleFactoryReset (
            AsyncWebServerRequest * request)
```

Handles factory reset, by calling the appropriate config helper functions.

Parameters

request	

5.5.2.7 handleLTESetConfig()

```
void ConfigWebpage::handleLTESetConfig (
            AsyncWebServerRequest * request)
```

Receive validate and set LTE settings.

Parameters

request	

5.5.2.8 handleMQTTSetConfig()

```
void ConfigWebpage::handleMQTTSetConfig (
            AsyncWebServerRequest * request)
```

Receive and validate the data from the MQTT form.

There is some fuckery going on to deal with booleans nicely

Options will only be saved if there are 0 errors logged Can still result in empty options

Parameters

request	

5.5.2.9 handleReceiveConfigJSON()

```
void ConfigWebpage::handleReceiveConfigJSON (
            AsyncWebServerRequest * request)
```

NOT YET IMPLEMENTED - NOT FUNCTIONAL.

Receives a new JSON config as a string for bulk assignment. Should take in a JSON string validate it and then save it to the NVS

Parameters

request	

5.5.2.10 handleReceiveInternetPreferences()

```
void ConfigWebpage::handleReceiveInternetPreferences (
            AsyncWebServerRequest * request)
```

Receive, validate and save internet preferences.

Parameters

request	

5.5.2.11 handleSendCurrentConfigJSON()

```
void ConfigWebpage::handleSendCurrentConfigJSON (
            AsyncWebServerRequest * request)
```

Sends the current configuration JSON as a string to the webpage.

This is part of a set of settings to make it easier to bulk view and set configurations

Parameters

request	

5.5.2.12 handleSendStatusJSON()

```
void ConfigWebpage::handleSendStatusJSON (
            AsyncWebServerRequest * request)
```

Sends the current status of the device as a JSON string.

Sends status updates to the webpage client with the current device parameters The corresponding JS will update the status page with any number of parameters

Parameters

request	

5.5.2.13 handleStationScanResults()

```
void ConfigWebpage::handleStationScanResults (
            AsyncWebServerRequest * request)
```

Sends back the num_networks found and the networks in a JSON array.

The page JS will disregard if there is only one element (i.e. no networks to show) Will keep being called till there are networks found

Parameters

request	

5.5.2.14 handleStationSendUpdate()

```
void ConfigWebpage::handleStationSendUpdate (
            void * pvParameters)  [static]
```

Attempt to connect to the WiFi network.

Sends updates for number of attempts while trying. Failure message and success message

Saves SSID and Password if successful only

Parameters

request	

5.5.2.15 handleStationSetConfig()

```
void ConfigWebpage::handleStationSetConfig (
            AsyncWebServerRequest * request)
```

Set the station configuration and attempt to connect.

Parameters

request	

5.5.2.16 handleStationStartScan()

```
void ConfigWebpage::handleStationStartScan (
             AsyncWebServerRequest * request)
```

Start scanning for WiFi networks asynchronously when called.

Parameters

request	

5.5.2.17 handleUpdateOTAConfig()

```
void ConfigWebpage::handleUpdateOTAConfig (
             AsyncWebServerRequest * request)
```

5.5.2.18 handleUpdateOTAFileUpload()

```
void ConfigWebpage::handleUpdateOTAFileUpload (
             AsyncWebServerRequest * request,
             String filename,
             size_t index,
             uint8_t * data,
             size_t len,
             bool final)
```

Handle receiving a file upload for OTA update.

Parameters

request	

5.5.2.19 handleUpdateOTAInternet()

```
void ConfigWebpage::handleUpdateOTAInternet (
             AsyncWebServerRequest * request)
```

5.5.2.20 handleUpdateOTANowRequest()

```
void ConfigWebpage::handleUpdateOTANowRequest (
             AsyncWebServerRequest * request)
```

Immediately check the URL for an OTA update.

Parameters

request	

5.5.2.21 handleUpdateOTAStatus()

```
void ConfigWebpage::handleUpdateOTAStatus (
             void * pvParameters)  [static]
```

Sends the current status of the OTA update.

Formats a string to have percentage and size of update

Parameters

request	

5.5.3 Member Data Documentation

5.5.3.1 _ap_ip

```
IPAddress ConfigWebpage::_ap_ip
```

5.5.3.2 _config_helper

```
ConfigHelper* ConfigWebpage::_config_helper
```

5.5.3.3 _dns_port

```
const byte ConfigWebpage::_dns_port = 53
```

5.5.3.4 _dnsServer

```
DNSServer* ConfigWebpage::_dnsServer
```

5.5.3.5 _event_source

```
AsyncEventSource* ConfigWebpage::_event_source
```

5.5.3.6 _net_msk

```
IPAddress ConfigWebpage::_net_msk
```

5.5.3.7 _ota_helper

```
OTAHelper* ConfigWebpage::_ota_helper
```

5.5.3.8 _server

```
AsyncWebServer* ConfigWebpage::_server
```

5.5.3.9 _sta_attempts

```
int ConfigWebpage::_sta_attempts [private]
```

5.5.3.10 _sta_pass

```
String ConfigWebpage::_sta_pass [private]
```

5.5.3.11 _sta_ssid

```
String ConfigWebpage::_sta_ssid [private]
```

5.5.3.12 _update_json

```
JsonDocument ConfigWebpage::_update_json
```

The documentation for this class was generated from the following files:

- lib/comms_handler/src/configwebpage/configwebpage.h
- lib/comms_handler/src/configwebpage/configwebpage.cpp

5.6 OTAHelper Class Reference

```
#include <otahelper.h>
```

Public Types

- enum OTAMethod_t { OTA_WIFI , OTA_LTE }

Public Member Functions

- OTAHelper (A76XX ∗a76xx)
- bool CheckUpdateJSON (String server, OTAHelper::OTAMethod_t method=OTAHelper::OTA_WIFI)
- bool CheckOTAHasMessage ()
- bool GetOTAMessage (String &message)

    Writes the OTA message to the message string and clears the message.
- void ClearOTAMessageStrings ()
- bool CheckJSONForNewVersion (bool str_msg=true)
- void handleOTAChunks (String filename, size_t index, uint8_t ∗data, size_t len, bool final, size_t reqlen=0, bool str_msg=true)
- void CallOTAInternetUpdateAsync (String url="", bool autorestart=false, bool str_msg=true)
- void UpdateOTAFileUpload ()
- void AddToUpdateString (String update_msg)
- void AddToErrorString (String error_msg)

Static Public Member Functions

- static void UpdateOTAInternetURL (void ∗pvParameters)

Public Attributes

- bool _str_msg = true
- String _server_json_url
- String _update_url
- int server_port
- bool _update_success = false
- bool _auto_restart = false
- String _error_msg
- String _update_msg
- bool _update_running = false
- JsonDocument _update_meta_json
- A76XX ∗ _a76xx = nullptr
- A76XXHTTPClient ∗ _a76xx_http = nullptr
- HTTPClient ∗ _wifi_http
- ConfigHelper ∗ _config_helper

5.6.1 Member Enumeration Documentation

5.6.1.1 OTAMethod_t

```
enum OTAHelper::OTAMethod_t
```

Enumerator

OTA_WIFI	
OTA_LTE	

5.6.2 Constructor & Destructor Documentation

5.6.2.1 OTAHelper()

```
OTAHelper::OTAHelper (
            A76XX * a76xx)
```

5.6.3 Member Function Documentation

5.6.3.1 AddToErrorString()

```
void OTAHelper::AddToErrorString (
            String error_msg)
```

5.6.3.2 AddToUpdateString()

```
void OTAHelper::AddToUpdateString (
            String update_msg)
```

5.6.3.3 CallOTAInternetUpdateAsync()

```
void OTAHelper::CallOTAInternetUpdateAsync (
            String url = "",
            bool autorestart = false,
            bool str_msg = true)
```

5.6.3.4 CheckJSONForNewVersion()

```
bool OTAHelper::CheckJSONForNewVersion (
            bool str_msg = true)
```

5.6.3.5 CheckOTAHasMessage()

```
bool OTAHelper::CheckOTAHasMessage ()
```

5.6.3.6 CheckUpdateJSON()

```
bool OTAHelper::CheckUpdateJSON (
            String server,
            OTAHelper::OTAMethod_t method = OTAHelper::OTA_WIFI)
```

5.6.3.7 ClearOTAMessageStrings()

```
void OTAHelper::ClearOTAMessageStrings ()
```

5.6.3.8 GetOTAMessage()

```
bool OTAHelper::GetOTAMessage (
            String & message)
```

Writes the OTA message to the message string and clears the message.

Parameters

message	String to write the message to

Returns

true if the message is an update message (i.e. success)

false if the message is an error message

5.6.3.9 handleOTAChunks()

```
void OTAHelper::handleOTAChunks (
             String filename,
             size_t index,
             uint8_t * data,
             size_t len,
             bool final,
             size_t reqlen = 0,
             bool str_msg = true)
```

5.6.3.10 UpdateOTAFileUpload()

```
void OTAHelper::UpdateOTAFileUpload ()
```

5.6.3.11 UpdateOTAInternetURL()

```
void OTAHelper::UpdateOTAInternetURL (
             void * pvParameters)  [static]
```

5.6.4 Member Data Documentation

5.6.4.1 _a76xx

```
A76XX* OTAHelper::_a76xx = nullptr
```

5.6.4.2 _a76xx_http

```
A76XXHTTPClient* OTAHelper::_a76xx_http = nullptr
```

5.6.4.3 _auto_restart

```
bool OTAHelper::_auto_restart = false
```

5.6.4.4 _config_helper

```
ConfigHelper* OTAHelper::_config_helper
```

5.6.4.5 _error_msg

```
String OTAHelper::_error_msg
```

5.6.4.6 _server_json_url

```
String OTAHelper::_server_json_url
```

5.6.4.7 _str_msg

```
bool OTAHelper::_str_msg = true
```

5.6.4.8 _update_meta_json

```
JsonDocument OTAHelper::_update_meta_json
```

5.6.4.9 _update_msg

```
String OTAHelper::_update_msg
```

5.6.4.10 _update_running

```
bool OTAHelper::_update_running = false
```

5.6.4.11 _update_success

```
bool OTAHelper::_update_success = false
```

5.6.4.12 _update_url

```
String OTAHelper::_update_url
```

5.6.4.13 _wifi_http

```
HTTPClient* OTAHelper::_wifi_http
```

5.6.4.14 server_port

```
int OTAHelper::server_port
```

The documentation for this class was generated from the following files:

- lib/comms_handler/src/ota/otahelper.h
- lib/comms_handler/src/ota/otahelper.cpp

Chapter 6

File Documentation

6.1 lib/comms_handler/src/comms_handler.cpp File Reference

```
#include "comms_handler.h"
#include "A76XX.h"
#include <esp_log.h>
```

6.2 lib/comms_handler/src/comms_handler.h File Reference

```
#include <Arduino.h>
#include <freertos/FreeRTOS.h>
#include <WiFi.h>
#include <MQTT.h>
#include <A76XX.h>
#include <metaheaders.h>
#include <ota/otahelper.h>
#include <config/confighelper.h>
#include <configwebpage/configwebpage.h>
```

Classes

- class CommsHandler
- struct CommsHandler::CommsHandler_MQTTMessage_t
- struct CommsHandler::BlinkPattern_t

Macros

- #define A76XX_PIN_TX 17
- #define A76XX_PIN_RX 16
- #define A76XX_PWR_PIN 12
- #define A76XX_RST_PIN 4
- #define SERIAL_LTE Serial1
- #define LTE_TIMEOUT 10000
- #define LTE_COMP_TIMEOUT 5000
- #define LTE_PUBLISH_TIMEOUT_S 30
- #define COMMS_INDICATOR_LED LED_BUILTIN
- #define PUB_TIMEOUT_S 5

6.2.1 Macro Definition Documentation

6.2.1.1 A76XX_PIN_RX

```
#define A76XX_PIN_RX 16
```

6.2.1.2 A76XX_PIN_TX

```
#define A76XX_PIN_TX 17
```

6.2.1.3 A76XX_PWR_PIN

```
#define A76XX_PWR_PIN 12
```

6.2.1.4 A76XX_RST_PIN

```
#define A76XX_RST_PIN 4
```

6.2.1.5 COMMS_INDICATOR_LED

```
#define COMMS_INDICATOR_LED LED_BUILTIN
```

6.2.1.6 LTE_COMP_TIMEOUT

```
#define LTE_COMP_TIMEOUT 5000
```

6.2.1.7 LTE_PUBLISH_TIMEOUT_S

```
#define LTE_PUBLISH_TIMEOUT_S 30
```

6.2.1.8 LTE_TIMEOUT

```
#define LTE_TIMEOUT 10000
```

6.2.1.9 PUB_TIMEOUT_S

```
#define PUB_TIMEOUT_S 5
```

6.2.1.10 SERIAL_LTE

```
#define SERIAL_LTE Serial1
```

6.3 comms_handler.h

Go to the documentation of this file.

```
#ifndef _COMMS_HANDLER
#define _COMMS_HANDLER

#include <Arduino.h>
#include <freertos/FreeRTOS.h>
#include <WiFi.h>
#include <MQTT.h>
#include <A76XX.h>

// Internal components
#include <metaheaders.h>
#include CONFIG_KEYS_HEADER
#include VERSION_HEADER

#include <ota/otahelper.h>
#include <config/confighelper.h>
#include <configwebpage/configwebpage.h>

/* -------------------------------- DEFINITIONS -------------------------------- */

#define A76XX_PIN_TX 17
#define A76XX_PIN_RX 16
#define A76XX_PWR_PIN 12
#define A76XX_RST_PIN 4

#define SERIAL_LTE Serial1
#define LTE_TIMEOUT 10000
#define LTE_COMP_TIMEOUT 5000
#define LTE_PUBLISH_TIMEOUT_S 30

#define COMMS_INDICATOR_LED LED_BUILTIN
#define PUB_TIMEOUT_S 5

/* -------------------------------- CLASS DEFINITION -------------------------------- */

class CommsHandler
{
public:
    // Data types
    // Internet preferences
    enum CommsHandler_Net_Pref_t
    {
        Comms_WiFi_Only,
        Comms_LTE_Only,
        Comms_WiFi_over_LTE,
        Comms_LTE_over_WiFi
    };

    // All states of operation
    enum CommsHandler_State_t
    {
        Comms_Unititialized,
        Comms_WiFi_Connected_Only,
        Comms_LTE_Connected_Only,
        Comms_WiFi_Connected_Primary,
        Comms_LTE_Connected_Primary,
        Comms_WiFi_Connected_Secondary,
        Comms_LTE_Connected_Secondary,
        Comms_Disconnected
    };

    // All error states
    enum CommsHandler_Error_t
    {
        Comms_No_Error,
        Comms_Error_WiFi,
        Comms_Error_LTE,
        Comms_Error_MQTT,
        Comms_Error_Unknown
    };

    struct CommsHandler_MQTTMessage_t
    {
        String topic;
        String payload;
        int qos;
        bool retain;
        bool dup;
    };

    // TODO: handle using existing clients (i.e. accept clients as arguments)
    //  ONLY CALL AFTER ARDUINO SETUP
    CommsHandler();

    bool addMQTTMessageToQueue(String topic,
                               String payload,
                               int qos = 0);

    bool addMQTTMessageToQueue(String topic,
                               String payload,
                               int qos = 0,
                               bool retain = false,
                               bool dup = false);

    bool subscribeToMQTTTopic(String topic, int qos = 0);
    bool unsubscribeFromMQTTTopic(String topic);

    bool messageAvailableMQTTTopic(String topic);

    static void CommsHandlerManagementTask(void *pvParameters);
    static void CommsHandlerQueueTask(void *pvParameters);

    static void CommsHandlerLTETask(void *pvParameters);
    static void CommsHandlerWiFiTask(void *pvParameters);

    struct BlinkPattern_t
    {
        int num_blinks;
        int times[10]; // Max 10 blinks
    };

    void setIndicatorLEDPattern(int count,
                                ...);

    static void IndicatorLEDPatternTask(void *pvParameters);

private:
    void _load_current_config();

    void _lte_power_on();
    void _lte_power_off();
    bool _lte_mqtt_init();
    bool _lte_mqtt_pub(String topic, String payload, int qos, bool retain, bool dup);
    void _lte_mqtt_sub();

    void _lte_get_state();

    bool _wifi_power_on();
    bool _wifi_mqtt_init();
    bool _wifi_mqtt_pub(String topic, String payload, int qos, bool retain, bool dup);
    void _wifi_mqtt_sub();
    void _wifi_power_off();

    void _wifi_get_state();

    // Sub components
    OTAHelper *_ota_helper;
    ConfigHelper *_config_helper;
    ConfigWebpage *_config_webpage;

    CommsHandler_State_t _state;
    CommsHandler_Error_t _error;
    CommsHandler_Net_Pref_t _net_preference;
    int _net_pref_switch_timeout;

    // Local variables
    QueueHandle_t _mqtt_msg_queue;
    QueueHandle_t _mqtt_msg_current;
    QueueHandle_t _led_blink_pattern;

    // Config variables
    String _mqtt_server;
    int _mqtt_port;
    String _mqtt_username;
    String _mqtt_password;
    String _mqtt_client_id;
    int _mqtt_keepalive;
    bool _mqtt_clean_session;
    String _mqtt_lwt_topic;
    String _mqtt_lwt_payload;
    int _mqtt_lwt_qos;

    int _size_mqtt_msg_queue;

    String _lte_apn;

    String _sta_ssid;
    String _sta_pass;

    String _ota_json_url;
    int _ota_freq_mins;

    // Clients
    A76XX *_lte_client = nullptr;
    A76XXMQTTClient *_lte_mqtt_client = nullptr;

    MQTTClient *_wifi_mqtt_client = nullptr;
    WiFiClient *_wifi_client = nullptr;
};

#endif // _COMMS_HANDLER
```

6.4 lib/comms_handler/src/config/confighelper.cpp File Reference

```
#include "config/confighelper.h"
#include <esp_log.h>
#include <WiFi.h>
```

6.5 lib/comms_handler/src/config/confighelper.h File Reference

```
#include <Arduino.h>
#include <ArduinoJson.h>
#include <Preferences.h>
#include "config/configkeys.h"
```

Classes

- class ConfigHelper

6.6 confighelper.h

Go to the documentation of this file.

```
#ifndef CONFIGHELPER_H
#define CONFIGHELPER_H

#include <Arduino.h>
#include <ArduinoJson.h>
#include <Preferences.h>
#include "config/configkeys.h"


class ConfigHelper {
    public:
        ConfigHelper(bool factoryreset);
        ~ConfigHelper();

        String getDeviceMACString();

        void restoreDefaultConfigJSON(bool write_to_nvs = false);
        void loadConfigJSONFromNVS();
        void saveConfigJSONToNVS();

        String getConfigJSONString();

        //TODO: handle a string of JSON (bulk assignment)

        // GETTERS
        // Value is needed to help with type
        int getConfigOption(const char *key, int default_value);
        String getConfigOption(const char *key, const char *default_value);
        bool getConfigOption(const char *key, bool default_value);
        float getConfigOption(const char *key, float default_value);

        // SETTERS
        void setConfigOption(const char *key, int value, bool write_to_nvs = true);
        void setConfigOption(const char *key, const char *value, bool write_to_nvs = true);
        void setConfigOption(const char *key, bool value, bool write_to_nvs = true);
        void setConfigOption(const char *key, float value, bool write_to_nvs = true);

    private:
        void getConfigOptionNVS(const char *key, bool open_namespace = true);
        void setConfigOptionNVS(const char *key, bool open_namespace = true);
        JsonDocument _config_json;
        const char *_config_namespace = "cfg";
        Preferences _preferences;
};

#endif // CONFIGHELPER_H
```

6.7 lib/comms_handler/src/config/configkeys.h File Reference

Macros

- #define DEVICE_UID_KEY "deviceid"
- #define DEVICE_NAME_KEY "name"
- #define CONFIG_PORTAL_USERNAME_KEY "pusername"
- #define CONFIG_PORTAL_PASSWORD_KEY "ppassword"
- #define ACCESSPOINT_SSID_KEY "apssid"
- #define ACCESSPOINT_PASS_KEY "appass"
- #define UID_REPLACEMENT_PATTERN "{UID}"
- #define NET_PRIORITY_PREF_KEY "netpref"
- #define NET_PRIORITY_SWITCH_TIME_KEY "netinterval"
- #define NET_WIFI_ONLY_PREF_OPTION "wifionly"
- #define NET_LTE_ONLY_PREF_OPTION "lteonly"
- #define NET_WIFI_THEN_LTE_PREF_OPTION "ltethenwifi"
- #define NET_LTE_THEN_WIFI_PREF_OPTION "wifithenlte"
- #define STATION_SSID_KEY "stassid"
- #define STATION_PASS_KEY "stapass"
- #define A76XX_APN_NAME_KEY "apnname"
- #define MQTT_CLIENT_ID_KEY "mqttid"
- #define MQTT_USERNAME_KEY "mqttuser"
- #define MQTT_PASSWORD_KEY "mqttpass"
- #define MQTT_SERVER_URL_KEY "mqtturl"
- #define MQTT_SERVER_PORT_KEY "mqttport"
- #define MQTT_KEEPALIVE_KEY "mkeepalive"
- #define MQTT_CLEAN_SESSION_KEY "mclean"
- #define MQTT_RETAIN_KEY "mretain"
- #define MQTT_CLEAN_SESSION_TRUE_OPTION "cleansessiontrue"
- #define MQTT_CLEAN_SESSION_FALSE_OPTION "cleansessionfalse"
- #define MQTT_RETAIN_TRUE_OPTION "retaintrue"
- #define MQTT_RETAIN_FALSE_OPTION "retainfalse"
- #define MQTT_LWT_TOPIC_KEY "lwttopic"
- #define MQTT_LWT_PAYLOAD_KEY "lwtpayload"
- #define MQTT_LWT_QOS_KEY "lwtqos"
- #define MQTT_QUEUE_SIZE_KEY "mqttqsize"
- #define OTA_JSON_URL_KEY "otajsonurl"
- #define OTA_BIN_URL_KEY "otabinurl"
- #define OTA_UPDATE_FREQUENCY_KEY "otafreq"

6.7.1 Macro Definition Documentation

6.7.1.1 A76XX_APN_NAME_KEY

```
#define A76XX_APN_NAME_KEY "apnname"
```

6.7.1.2 ACCESSPOINT_PASS_KEY

```
#define ACCESSPOINT_PASS_KEY "appass"
```

6.7.1.3 ACCESSPOINT_SSID_KEY

```
#define ACCESSPOINT_SSID_KEY "apssid"
```

6.7.1.4 CONFIG_PORTAL_PASSWORD_KEY

```
#define CONFIG_PORTAL_PASSWORD_KEY "ppassword"
```

6.7.1.5 CONFIG_PORTAL_USERNAME_KEY

```
#define CONFIG_PORTAL_USERNAME_KEY "pusername"
```

6.7.1.6 DEVICE_NAME_KEY

```
#define DEVICE_NAME_KEY "name"
```

6.7.1.7 DEVICE_UID_KEY

```
#define DEVICE_UID_KEY "deviceid"
```

6.7.1.8 MQTT_CLEAN_SESSION_FALSE_OPTION

```
#define MQTT_CLEAN_SESSION_FALSE_OPTION "cleansessionfalse"
```

6.7.1.9 MQTT_CLEAN_SESSION_KEY

```
#define MQTT_CLEAN_SESSION_KEY "mclean"
```

6.7.1.10 MQTT_CLEAN_SESSION_TRUE_OPTION

```
#define MQTT_CLEAN_SESSION_TRUE_OPTION "cleansessiontrue"
```

6.7.1.11 MQTT_CLIENT_ID_KEY

```
#define MQTT_CLIENT_ID_KEY "mqttid"
```

6.7.1.12 MQTT_KEEPALIVE_KEY

```
#define MQTT_KEEPALIVE_KEY "mkeepalive"
```

6.7.1.13 MQTT_LWT_PAYLOAD_KEY

```
#define MQTT_LWT_PAYLOAD_KEY "lwtpayload"
```

6.7.1.14 MQTT_LWT_QOS_KEY

```
#define MQTT_LWT_QOS_KEY "lwtqos"
```

6.7.1.15 MQTT_LWT_TOPIC_KEY

```
#define MQTT_LWT_TOPIC_KEY "lwttopic"
```

6.7.1.16 MQTT_PASSWORD_KEY

```
#define MQTT_PASSWORD_KEY "mqttpass"
```

6.7.1.17 MQTT_QUEUE_SIZE_KEY

```
#define MQTT_QUEUE_SIZE_KEY "mqttqsize"
```

6.7.1.18 MQTT_RETAIN_FALSE_OPTION

```
#define MQTT_RETAIN_FALSE_OPTION "retainfalse"
```

6.7.1.19 MQTT_RETAIN_KEY

```
#define MQTT_RETAIN_KEY "mretain"
```

6.7.1.20 MQTT_RETAIN_TRUE_OPTION

```
#define MQTT_RETAIN_TRUE_OPTION "retaintrue"
```

6.7.1.21 MQTT_SERVER_PORT_KEY

```
#define MQTT_SERVER_PORT_KEY "mqttport"
```

6.7.1.22 MQTT_SERVER_URL_KEY

```
#define MQTT_SERVER_URL_KEY "mqtturl"
```

6.7.1.23 MQTT_USERNAME_KEY

```
#define MQTT_USERNAME_KEY "mqttuser"
```

6.7.1.24 NET_LTE_ONLY_PREF_OPTION

```
#define NET_LTE_ONLY_PREF_OPTION "lteonly"
```

6.7.1.25 NET_LTE_THEN_WIFI_PREF_OPTION

```
#define NET_LTE_THEN_WIFI_PREF_OPTION "wifithenlte"
```

6.7.1.26 NET_PRIORITY_PREF_KEY

```
#define NET_PRIORITY_PREF_KEY "netpref"
```

6.7.1.27 NET_PRIORITY_SWITCH_TIME_KEY

```
#define NET_PRIORITY_SWITCH_TIME_KEY "netinterval"
```

6.7.1.28 NET_WIFI_ONLY_PREF_OPTION

```
#define NET_WIFI_ONLY_PREF_OPTION "wifionly"
```

6.7.1.29 NET_WIFI_THEN_LTE_PREF_OPTION

```
#define NET_WIFI_THEN_LTE_PREF_OPTION "ltethenwifi"
```

6.7.1.30 OTA_BIN_URL_KEY

```
#define OTA_BIN_URL_KEY "otabinurl"
```

6.7.1.31 OTA_JSON_URL_KEY

```
#define OTA_JSON_URL_KEY "otajsonurl"
```

6.7.1.32 OTA_UPDATE_FREQUENCY_KEY

```
#define OTA_UPDATE_FREQUENCY_KEY "otafreq"
```

6.7.1.33 STATION_PASS_KEY

```
#define STATION_PASS_KEY "stapass"
```

6.7.1.34 STATION_SSID_KEY

```
#define STATION_SSID_KEY "stassid"
```

6.7.1.35 UID_REPLACEMENT_PATTERN

```
#define UID_REPLACEMENT_PATTERN "{UID}"
```

6.8 configkeys.h

Go to the documentation of this file.

```
#ifndef CONFIG_KEYS_H
#define CONFIG_KEYS_H

// KEY STRINGS FOR CONFIGURATIONS
// DEFAULT VALUES FOR THE CONFIGURATIONS ARE IN THE CPP FILE
#define DEVICE_UID_KEY "deviceid"
#define DEVICE_NAME_KEY "name"
#define CONFIG_PORTAL_USERNAME_KEY "pusername"
#define CONFIG_PORTAL_PASSWORD_KEY "ppassword"

#define ACCESSPOINT_SSID_KEY "apssid"
#define ACCESSPOINT_PASS_KEY "appass"

#define UID_REPLACEMENT_PATTERN "{UID}"

#define NET_PRIORITY_PREF_KEY "netpref"
#define NET_PRIORITY_SWITCH_TIME_KEY "netinterval"

#define NET_WIFI_ONLY_PREF_OPTION "wifionly"
#define NET_LTE_ONLY_PREF_OPTION "lteonly"
#define NET_WIFI_THEN_LTE_PREF_OPTION "ltethenwifi"
#define NET_LTE_THEN_WIFI_PREF_OPTION "wifithenlte"

#define STATION_SSID_KEY "stassid"
#define STATION_PASS_KEY "stapass"

#define A76XX_APN_NAME_KEY "apnname"

#define MQTT_CLIENT_ID_KEY "mqttid"
#define MQTT_USERNAME_KEY "mqttuser"
#define MQTT_PASSWORD_KEY "mqttpass"
#define MQTT_SERVER_URL_KEY "mqtturl"
#define MQTT_SERVER_PORT_KEY "mqttport"

#define MQTT_KEEPALIVE_KEY "mkeepalive"
#define MQTT_CLEAN_SESSION_KEY "mclean"
#define MQTT_RETAIN_KEY "mretain"

```

```
#define MQTT_CLEAN_SESSION_TRUE_OPTION "cleansessiontrue"
#define MQTT_CLEAN_SESSION_FALSE_OPTION "cleansessionfalse"

#define MQTT_RETAIN_TRUE_OPTION "retaintrue"
#define MQTT_RETAIN_FALSE_OPTION "retainfalse"

#define MQTT_LWT_TOPIC_KEY "lwttopic"
#define MQTT_LWT_PAYLOAD_KEY "lwtpayload"
#define MQTT_LWT_QOS_KEY "lwtqos"
#define MQTT_QUEUE_SIZE_KEY "mqttqsize"


#define OTA_JSON_URL_KEY "otajsonurl"
#define OTA_BIN_URL_KEY "otabinurl"
#define OTA_UPDATE_FREQUENCY_KEY "otafreq"



#endif // FR_CONFIG_H
```

6.9 lib/comms_handler/src/configwebpage/configwebpage.cpp File Reference

```
#include "configwebpage.h"
#include <metaheaders.h>
```

6.10 lib/comms_handler/src/configwebpage/configwebpage.h File Reference

```
#include <Arduino.h>
#include <ESPAsyncWebServer.h>
#include <DNSServer.h>
#include <ArduinoJson.h>
#include "config/confighelper.h"
#include "ota/otahelper.h"
#include <freertos/FreeRTOS.h>
```

Classes

- class ConfigWebpage

6.11 configwebpage.h

Go to the documentation of this file.

```
#ifndef CONFIG_WEBPAGE_H
#define CONFIG_WEBPAGE_H

#include <Arduino.h>
#include <ESPAsyncWebServer.h>
#include <DNSServer.h>
#include <ArduinoJson.h>
#include "config/confighelper.h"
#include "ota/otahelper.h"

#include <freertos/FreeRTOS.h>

```

```
class ConfigWebpage {
public:
    ConfigWebpage(ConfigHelper *config_helper = nullptr, OTAHelper *ota_helper = nullptr);

    static void ConfigServerTask(void *pvParameters);

    void ConfigServeRootPage(AsyncWebServerRequest *request);

    /* --------------------------- CALL BACK FUNCTIONS -------------------------- */

    void handleSendCurrentConfigJSON(AsyncWebServerRequest *request);
    void handleReceiveConfigJSON(AsyncWebServerRequest *request);
    void handleSendStatusJSON(AsyncWebServerRequest *request);

    void handleDeviceSettingsConfig(AsyncWebServerRequest *request);
    void handleFactoryReset(AsyncWebServerRequest *request);
    void handleDeviceRestart(AsyncWebServerRequest *request);

    void handleUpdateOTAConfig(AsyncWebServerRequest *request);
    static void handleUpdateOTAStatus(void *pvParameters);
    void handleUpdateOTAInternet(AsyncWebServerRequest *request);
    void handleUpdateOTAFileUpload(AsyncWebServerRequest *reques, String filename, size_t index, uint8_t *data, size_t len, bool final);
    void handleUpdateOTANowRequest(AsyncWebServerRequest *request);

    void handleReceiveInternetPreferences(AsyncWebServerRequest *request);

    void handleStationStartScan(AsyncWebServerRequest *request);
    void handleStationScanResults(AsyncWebServerRequest *request);
    void handleStationSetConfig(AsyncWebServerRequest *request);
    static void handleStationSendUpdate(void *pvParameters);

    void handleLTESetConfig(AsyncWebServerRequest *request);

    void handleAccessPointSetConfig(AsyncWebServerRequest *request);

    void handleMQTTSetConfig(AsyncWebServerRequest *request);

    /* ---------------------- END OF CALL BACK FUNCTIONS ----------------------- */

    ConfigHelper *_config_helper;
    JsonDocument _update_json;
    OTAHelper *_ota_helper;
    AsyncWebServer *_server;
    AsyncEventSource *_event_source;
    DNSServer *_dnsServer;
    IPAddress _ap_ip;
    IPAddress _net_msk;
    const byte _dns_port = 53;

private:

    int _sta_attempts;
    String _sta_ssid;
    String _sta_pass;
};

#endif // CONFIG_WEBPAGE_H
```

6.12 lib/comms_handler/src/configwebpage/webpage/endpoints.h File Reference

Macros

- #define SERVER_SIDE_EVENTS_ENDPOINT "/events"
- #define INTERNET_PREF_CONFIG_ENDPOINT "/netpref"
- #define STA_START_SCAN_ENDPOINT "/startscan"
- #define STA_SCAN_RESULTS_ENDPOINT "/getscan"
- #define STA_SET_CONFIG_ENDPOINT "/stacfg"
- #define STA_SEND_UPDATE_ENDPOINT "/stacfgupdate"
- #define LTE_SET_CONFIG_ENDPOINT "/ltecfg"
- #define MQTT_SET_CONFIG_ENDPOINT "/mqttcfg"
- #define AP_SET_CONFIG_ENDPOINT "/apsetconfig"

- #define FACTORY_RESET_ENDPOINT "/factoryreset"
- #define RESTART_DEVICE_ENDPOINT "/restartdevice"
- #define UPDATE_FIRMWARE_UPLOAD_ENDPOINT "/otafwfile"
- #define UPDATE_OTA_BIN_URL_ENDPOINT "/binurlotanow"
- #define UPDATE_OTA_CONFIG_ENDPOINT "/updateotaconfig"
- #define UPDATE_OTA_STATUS_ENDPOINT "/getotastatus"
- #define CONFIG_JSON_GET_ENDPOINT "/cfggetjson"
- #define CONFIG_JSON_SET_ENDPOINT "/configsetjson"
- #define DEVICE_GET_STATUS_ENDPOINT "/getstatus"
- #define DEVICE_SET_SETTINGS_ENDPOINT "/devicecfg"

6.12.1 Macro Definition Documentation

6.12.1.1 AP_SET_CONFIG_ENDPOINT

```
#define AP_SET_CONFIG_ENDPOINT "/apsetconfig"
```

6.12.1.2 CONFIG_JSON_GET_ENDPOINT

```
#define CONFIG_JSON_GET_ENDPOINT "/cfggetjson"
```

6.12.1.3 CONFIG_JSON_SET_ENDPOINT

```
#define CONFIG_JSON_SET_ENDPOINT "/configsetjson"
```

6.12.1.4 DEVICE_GET_STATUS_ENDPOINT

```
#define DEVICE_GET_STATUS_ENDPOINT "/getstatus"
```

6.12.1.5 DEVICE_SET_SETTINGS_ENDPOINT

```
#define DEVICE_SET_SETTINGS_ENDPOINT "/devicecfg"
```

6.12.1.6 FACTORY_RESET_ENDPOINT

```
#define FACTORY_RESET_ENDPOINT "/factoryreset"
```

6.12.1.7 INTERNET_PREF_CONFIG_ENDPOINT

```
#define INTERNET_PREF_CONFIG_ENDPOINT "/netpref"
```

6.12.1.8 LTE_SET_CONFIG_ENDPOINT

```
#define LTE_SET_CONFIG_ENDPOINT "/ltecfg"
```

6.12.1.9 MQTT_SET_CONFIG_ENDPOINT

```
#define MQTT_SET_CONFIG_ENDPOINT "/mqttcfg"
```

6.12.1.10 RESTART_DEVICE_ENDPOINT

```
#define RESTART_DEVICE_ENDPOINT "/restartdevice"
```

6.12.1.11 SERVER_SIDE_EVENTS_ENDPOINT

```
#define SERVER_SIDE_EVENTS_ENDPOINT "/events"
```

6.12.1.12 STA_SCAN_RESULTS_ENDPOINT

```
#define STA_SCAN_RESULTS_ENDPOINT "/getscan"
```

6.12.1.13 STA_SEND_UPDATE_ENDPOINT

```
#define STA_SEND_UPDATE_ENDPOINT "/stacfgupdate"
```

6.12.1.14 STA_SET_CONFIG_ENDPOINT

```
#define STA_SET_CONFIG_ENDPOINT "/stacfg"
```

6.12.1.15 STA_START_SCAN_ENDPOINT

```
#define STA_START_SCAN_ENDPOINT "/startscan"
```

6.12.1.16 UPDATE_FIRMWARE_UPLOAD_ENDPOINT

```
#define UPDATE_FIRMWARE_UPLOAD_ENDPOINT "/otafwfile"
```

6.12.1.17 UPDATE_OTA_BIN_URL_ENDPOINT

```
#define UPDATE_OTA_BIN_URL_ENDPOINT "/binurlotanow"
```

6.12.1.18 UPDATE_OTA_CONFIG_ENDPOINT

```
#define UPDATE_OTA_CONFIG_ENDPOINT "/updateotaconfig"
```

6.12.1.19 UPDATE_OTA_STATUS_ENDPOINT

```
#define UPDATE_OTA_STATUS_ENDPOINT "/getotastatus"
```

6.13 endpoints.h

Go to the documentation of this file.

```
#ifndef ENDPOINTS_H
#define ENDPOINTS_H


// Websockets
#define SERVER_SIDE_EVENTS_ENDPOINT "/events"

#define INTERNET_PREF_CONFIG_ENDPOINT "/netpref"

#define STA_START_SCAN_ENDPOINT "/startscan"
#define STA_SCAN_RESULTS_ENDPOINT "/getscan"
#define STA_SET_CONFIG_ENDPOINT "/stacfg"
#define STA_SEND_UPDATE_ENDPOINT "/stacfgupdate"

#define LTE_SET_CONFIG_ENDPOINT "/ltecfg"

#define MQTT_SET_CONFIG_ENDPOINT "/mqttcfg"

#define AP_SET_CONFIG_ENDPOINT "/apsetconfig"

#define FACTORY_RESET_ENDPOINT "/factoryreset"
#define RESTART_DEVICE_ENDPOINT "/restartdevice"

#define UPDATE_FIRMWARE_UPLOAD_ENDPOINT "/otafwfile"
#define UPDATE_OTA_BIN_URL_ENDPOINT "/binurlotanow"

#define UPDATE_OTA_CONFIG_ENDPOINT "/updateotaconfig"

#define UPDATE_OTA_STATUS_ENDPOINT "/getotastatus"

#define CONFIG_JSON_GET_ENDPOINT "/cfggetjson"
#define CONFIG_JSON_SET_ENDPOINT "/configsetjson"

#define DEVICE_GET_STATUS_ENDPOINT "/getstatus"
#define DEVICE_SET_SETTINGS_ENDPOINT "/devicecfg"


#endif // ENDPOINTS_H
```

6.14 lib/comms_handler/src/configwebpage/webpage/preprocess.py File Reference

Namespaces

- namespace preprocess

Functions

- preprocess.extract_definitions (header_file)
- preprocess.replace_placeholders (html_file, definitions, dest_file)
- preprocess.compress_page_as_header (src_path, dest_path)
- preprocess.html_to_progmem (html_file_path, output_cpp_file, variable_name="html_gz")
- preprocess.preprocess_webpage (env)

Variables

- str preprocess.script_dir = "lib/comms_handler/src/configwebpage/webpage"
- preprocess.src_html_path = os.path.join(script_dir, "websrc.html")
- preprocess.temp_html_path = os.path.join(script_dir, "prepped.html")
- preprocess.dest_html_path = os.path.join(script_dir, "webpage.cpp")
- preprocess.src_header_endpoints = os.path.join(script_dir, "endpoints.h")
- str preprocess.config_dir = "lib/comms_handler/src/config"
- preprocess.src_header_keys = os.path.join(config_dir, "configkeys.h")
- str preprocess.src_dir = "src/"
- preprocess.src_metadata = os.path.join(src_dir, "metadata.h")

6.15 lib/comms_handler/src/configwebpage/webpage/webpage.cpp File Reference

```
#include <Arduino.h>
#include <pgmspace.h>
#include "configwebpage/webpage/webpage.h"
```

Variables

- const size_t HTML_GZ_PROGMEM_LEN = 9169

  Length variable for the HTML_GZ_PROGMEM array.
- const uint8_t HTML_GZ_PROGMEM[ ] PROGMEM

  HTML_GZ_PROGMEM array containing the gzipped version of the webpage from the python preprocessor.

6.15.1 Variable Documentation

6.15.1.1 HTML_GZ_PROGMEM_LEN

```
const size_t HTML_GZ_PROGMEM_LEN = 9169
```

Length variable for the HTML_GZ_PROGMEM array.

6.15.1.2 PROGMEM

```
const uint8_t HTML_GZ_PROGMEM [ ] PROGMEM
```

Initial value:

```
= {
0x1F, 0x8B, 0x08, 0x00, 0x66, 0x55, 0xCE, 0x66, 0x02, 0xFF, 0xED, 0x7D, 0x6B, 0x77, 0xDB, 0x38, 0x92, 0xE8,
      0x77, 0xFF, 0x0A, 0x84, 0x7D, 0x66, 0x24, 0x77, 0x2C, 0xEA, 0x61, 0x3B, 0x71, 0x64, 0x5B, 0x73, 0xDD,
      0x8E, 0xD3, 0xED, 0xD9, 0x24, 0xF6, 0xC4, 0xCE, 0xCE, 0xF4, 0xC9, 0xCD, 0xCD, 0xA1, 0x44, 0x48, 0xE2,
      0x9A, 0x22, 0xD5, 0x24, 0x65, 0xC7, 0xD3, 0x27, 0xFF, 0xFD, 0x56, 0x01, 0x20, 0x05, 0xE2, 0x41, 0x52,
      0xB6, 0xD3, 0x33, 0xBB, 0x67, 0x93, 0x99, 0x8E, 0x44, 0x00, 0x85, 0xAA, 0x42, 0xBD, 0x50, 0x28, 0x50,
      0x47, 0xCF, 0x5E, 0x5F, 0x9C, 0x5E, 0xFF, 0x7A, 0x79, 0x46, 0xE6, 0xD9, 0x22, 0x1C, 0x6D, 0x1D, 0xE1,
      0x3F, 0x24, 0xF4, 0xA2, 0xD9, 0xB1, 0x43, 0x23, 0x67, 0xB4, 0x05, 0x4F, 0xA8, 0xE7, 0x8F, 0xB6, 0x08,
      0xFC, 0x39, 0x5A, 0xD0, 0xCC, 0x23, 0x93, 0xB9, 0x97, 0xA4, 0x34, 0x3B, 0x76, 0x56, 0xD9, 0xB4, 0x73,
      0xE0, 0xC8, 0x4D, 0x91, 0xB7, 0xA0, 0xC7, 0xCE, 0x6D, 0x40, 0xEF, 0x96, 0x71, 0x92, 0x39, 0x64, 0x12,
      0x47, 0x19, 0x8D, 0xA0, 0xEB, 0x5D, 0xE0, 0x67, 0xF3, 0x63, 0x9F, 0xDE, 0x06, 0x13, 0xDA, 0x61, 0x5F,
      0x76, 0x48, 0x10, 0x05, 0x59, 0xE0, 0x85, 0x9D, 0x74, 0xE2, 0x85, 0xF4, 0xB8, 0xEF, 0xF6, 0x76, 0xC8,
      0xC2, 0xFB, 0x1A, 0x2C, 0x56, 0x8B, 0xFC, 0x51, 0x0E, 0x3B, 0x0B, 0xB2, 0x90, 0x8E, 0x4E, 0xE3, 0x68,
      0x1A, 0xCC, 0xC8, 0xA5, 0x37, 0xA3, 0x47, 0x5D, 0xFE, 0x88, 0x37, 0xA7, 0xD9, 0x7D, 0xFE, 0x19, 0xFF,
      0x0C, 0x93, 0x38, 0xCE, 0x76, 0xD6, 0x5F, 0x87, 0x63, 0x6F, 0x72, 0xE3, 0x27, 0xF1, 0x92, 0xFC, 0x5E,
      0x3C, 0xC4, 0x3F, 0x9D, 0x4E, 0xEA, 0x45, 0x69, 0x67, 0x0A, 0x38, 0x0E, 0x49, 0xC7, 0x5B, 0x2E, 0x43,
      0xDA, 0x49, 0xEF, 0xD3, 0x8C, 0x2E, 0x76, 0xC8, 0x4F, 0x61, 0x10, 0xDD, 0xBC, 0xF3, 0x26, 0x57, 0xEC,
      0xFB, 0x1B, 0xE8, 0xB2, 0x43, 0x9C, 0x93, 0x5B, 0x1A, 0x05, 0x09, 0x79, 0x4F, 0xBF, 0x66, 0xCE, 0x0E,
      0xE1, 0xDF, 0xE0, 0xF1, 0xFB, 0x60, 0x31, 0x5E, 0xA5, 0xE4, 0x0A, 0x80, 0x91, 0xB7, 0xD0, 0xF0, 0x21,
      0x1E, 0xC7, 0x59, 0x8C, 0x0D, 0xF0, 0x0F, 0x7B, 0x0C, 0x0F, 0x9D, 0x2B, 0x3A, 0x8B, 0x29, 0xF9, 0x78,
      0x8E, 0x23, 0x13, 0x20, 0x7B, 0x87, 0xFC, 0x42, 0xC3, 0x5B, 0x9A, 0x05, 0x13, 0x0F, 0x5A, 0x8B, 0xCF,
      0x00, 0x7D, 0x45, 0xA1, 0x0F, 0x43, 0x2D, 0xA5, 0x49, 0x30, 0x3D, 0x54, 0x90, 0x5E, 0xC4, 0x51, 0x2C,
      0x90, 0x06, 0x8E, 0xA4, 0x71, 0xE8, 0xA5, 0x3B, 0xE4, 0x1D, 0x8D, 0x42, 0x98, 0xF2, 0x5D, 0x1C, 0x79,
      0x13, 0x9C, 0xFA, 0x24, 0xF2, 0x81, 0x83, 0xF8, 0x3D, 0xC6, 0xC9, 0x3F, 0x8E, 0x57, 0x51, 0xB6, 0xCA,
      0xBF, 0x22, 0x84, 0x74, 0xE9, 0x4D, 0xA8, 0x0A, 0x3A, 0xCD, 0x3C, 0x18, 0x97, 0xF8, 0x9D, 0x71, 0x9C,
      0xF8, 0x34, 0xE9, 0x24, 0x9E, 0x1F, 0xAC, 0xD2, 0x21, 0xD9, 0x5F, 0x7E, 0x55, 0xBB, 0x8E, 0x67, 0x43,
      0xF2, 0xC3, 0x74, 0xAA, 0x61, 0xE7, 0x4D, 0x26, 0xB0, 0xE0, 0xA2, 0x79, 0x7F, 0xFA, 0x52, 0xEF, 0x91,
      0x01, 0xFB, 0xA0, 0x71, 0xD0, 0xC7, 0xBF, 0xA6, 0xC6, 0x4E, 0x18, 0xCC, 0xE6, 0xD8, 0x65, 0xFF, 0x00,
      0xFF, 0x6A, 0x33, 0x33, 0xDC, 0xA0, 0xF9, 0xE0, 0xD5, 0x01, 0xF5, 0xF6, 0xCC, 0x08, 0x40, 0x73, 0xCF,
      0xDF, 0x7B, 0xE9, 0xF5, 0x2D, 0xF8, 0xCD, 0xE3, 0x5B, 0x06, 0xA3, 0x3F, 0x78, 0xF1, 0x82, 0x0E, 0x2C,
      0x9D, 0x38, 0xA6, 0xB7, 0x5E, 0xD2, 0x46, 0x7A, 0xB7, 0xD5, 0x5E, 0x93, 0xD8, 0xA7, 0x00, 0xC2, 0x3F,
      0xE8, 0x8F, 0x5F, 0xF4, 0xD4, 0xC6, 0x65, 0x42, 0xA7, 0x71, 0xB2, 0xF0, 0xB2, 0x8C, 0xFA, 0xD0, 0x69,
      0x6F, 0x4F, 0x43, 0x74, 0xE1, 0x25, 0x37, 0xAC, 0x6D, 0xEA, 0xEF, 0xAA, 0x6D, 0x7E, 0x90, 0x7A, 0xE3,
      0x90, 0xB5, 0xD2, 0x29, 0xFE, 0x2D, 0xDA, 0xBF, 0x6D, 0x15, 0x1F, 0xFF, 0xCF, 0x82, 0xFA, 0x81, 0x47,
      0xDA, 0x38, 0x15, 0x4D, 0x52, 0xC0, 0x27, 0x8C, 0x13, 0x50, 0x9D, 0x39, 0x5D, 0xD0, 0x21, 0x2C, 0xE3,
      0xCD, 0x36, 0x08, 0x7C, 0x09, 0xB0, 0xA2, 0x19, 0x95, 0xDA, 0x81, 0x7F, 0x4A, 0x10, 0x09, 0x82, 0x3C,
      0xD4, 0xFA, 0x08, 0x51, 0x30, 0x2D, 0xA7, 0x2E, 0x11, 0x83, 0x31, 0xFE, 0x35, 0xF5, 0x12, 0x52, 0xE1,
      0x4F, 0xF0, 0xAF, 0xAD, 0x43, 0x21, 0x19, 0xDE, 0x18, 0xFF, 0xDA, 0x67, 0x63, 0xB2, 0x39, 0xDE, 0xED,
      0xF5, 0x2A, 0x10, 0xCA, 0x45, 0x60, 0x3A, 0xA5, 0xBD, 0x57, 0xAF, 0x2A, 0x3A, 0x56, 0x8A, 0x41, 0x49,
      0x14, 0xA6, 0xBD, 0x17, 0x83, 0x57, 0x03, 0x53, 0x07, 0x45, 0x1C, 0x26, 0x13, 0x23, 0x8D, 0xD2, 0xB2,
      0xF7, 0xFB, 0x0A, 0x33, 0xBF, 0x95, 0x97, 0x32, 0x58, 0xCC, 0xCA, 0x0B, 0x79, 0x1B, 0xF8, 0x34, 0x36,
      0xAC, 0x61, 0x0C, 0x8A, 0x1E, 0x64, 0xF7, 0x43, 0xE2, 0x1E, 0x28, 0xF0, 0x0C, 0x90, 0x7F, 0x94, 0xCC,
      0xE6, 0x18, 0x31, 0xA6, 0xD2, 0x03, 0x6F, 0x9A, 0xD1, 0x44, 0x99, 0x61, 0x1C, 0x7F, 0xED, 0xA4, 0xC1,
      0x3F, 0x83, 0x08, 0x56, 0x57, 0x18, 0x0D, 0x78, 0x64, 0x02, 0x8D, 0x5C, 0xF4, 0x12, 0xEA, 0xAD, 0x01,
      0xA6, 0x34, 0xA4, 0x13, 0x49, 0x1C, 0x83, 0x68, 0xB9, 0x92, 0xBE, 0x2E, 0x93, 0x78, 0x96, 0xD0, 0x34,
      0x55, 0xAD, 0xF6, 0x1D, 0x1D, 0xDF, 0x04, 0x19, 0xDA, 0x6B, 0xEA, 0x25, 0x5E, 0x34, 0x01, 0xC6, 0x47,
      0x71, 0xA4, 0xDA, 0xB2, 0x45, 0xFC, 0xCF, 0x9A, 0x2E, 0x6A, 0xAB, 0x09, 0x69, 0xE6, 0x0C, 0xCB, 0xF3,
      0xA3, 0xE5, 0xED, 0x4C, 0xBD, 0x45, 0x10, 0xDE, 0xE7, 0x42, 0x51, 0xB8, 0x11, 0x45, 0x36, 0xD2, 0x49,
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      0xA2, 0x71, 0xEC, 0xDF, 0x2B, 0x13, 0x31, 0xE5, 0xCB, 0xA7, 0x40, 0xEE, 0x29, 0xD0, 0x51, 0x6F, 0x67,
      0x49, 0xBC, 0x8A, 0xFC, 0x4E, 0xA9, 0xAB, 0x26, 0xA2, 0xB3, 0x24, 0xF0, 0x01, 0xC0, 0x62, 0x19, 0x7A,
      0x19, 0xC5, 0xBE, 0xAB, 0x45, 0x04, 0x46, 0xBD, 0x3F, 0x4D, 0xC8, 0x22, 0x88, 0xDA, 0x7B, 0xFB, 0x09,
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      0x4E, 0xB9, 0xB6, 0xF6, 0xDD, 0xFD, 0x72, 0x2B, 0x88, 0x39, 0xE0, 0x02, 0xEC, 0x43, 0xCC, 0x6C, 0xDC,
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      0xC9, 0xBC, 0xAF, 0x01, 0xFA, 0xCA, 0x03, 0x36, 0x40, 0x7A, 0xD0, 0xEB, 0xA9, 0x91, 0x40, 0x2E, 0x20,
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      0xB9, 0xBA, 0xEE, 0x48, 0xBA, 0xE5, 0xBE, 0xB2, 0xE0, 0xAD, 0xAD, 0x92, 0x34, 0x68, 0xD7, 0x36, 0x66,
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      0xFF, 0x4F, 0xDB, 0x3B, 0xDA, 0xC0, 0xFE, 0x2E, 0x1F, 0x59, 0xEE, 0xA8, 0x41, 0xB2, 0xAF, 0xC4, 0x32,
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      0xBC, 0xBD, 0x30, 0xF7, 0x10, 0x8B, 0xC0, 0xF7, 0x43, 0x6A, 0xDC, 0x37, 0x2E, 0x40, 0xF9, 0x8D, 0x8E,
      0x6C, 0x8D, 0x69, 0x42, 0x43, 0xD8, 0xC6, 0xDF, 0xD2, 0xA6, 0x78, 0x3E, 0x67, 0x8A, 0x51, 0x81, 0xED,
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      0x73, 0x78, 0xB0, 0x6F, 0xE5, 0xB0, 0xDE, 0x24, 0xD7, 0xAE, 0x0C, 0x34, 0x9B, 0xD8, 0x88, 0xC1, 0xFD,
      0x81, 0x95, 0xC3, 0xD8, 0xF2, 0x98, 0xC4, 0x8F, 0x16, 0xF3, 0x96, 0x23, 0x04, 0x53, 0x94, 0x60, 0x8B,
      0x14, 0x6C, 0x8E, 0xD5, 0x9A, 0xDE, 0x91, 0xF5, 0x13, 0x17, 0xE6, 0xB3, 0x96, 0x5D, 0x15, 0x27, 0x29,
      0x95, 0x31, 0x93, 0xAD, 0xD4, 0x46, 0x82, 0x3E, 0x0D, 0x42, 0x6A, 0x3B, 0x6A, 0x37, 0xC6, 0xA7, 0x73,
      0xFB, 0x89, 0xDD, 0xB0, 0x3E, 0x71, 0x61, 0x0A, 0x11, 0x8B, 0x5C, 0xEE, 0x83, 0x2A, 0xCC, 0xB0, 0x98,
      0xBA, 0xDA, 0x08, 0x6F, 0x12, 0xCB, 0x5A, 0xF4, 0x81, 0x57, 0x6C, 0x9B, 0x53, 0xEB, 0x3F, 0x68, 0xB6,
      0x68, 0x9D, 0x53, 0xE1, 0xBE, 0xDE, 0x8A, 0xB6, 0x67, 0x0E, 0x28, 0x45, 0x01, 0xBB, 0x71, 0xE5, 0xE4,
      0xE2, 0x5F, 0x53, 0xE1, 0xEF, 0x63, 0x52, 0x76, 0x15, 0x91, 0x7A, 0xBE, 0x46, 0xB6, 0x55, 0xE0, 0x9B,
      0x56, 0x4B, 0x75, 0x54, 0xEF, 0xB0, 0x22, 0x4C, 0x3D, 0x34, 0x17, 0x35, 0x7D, 0xAD, 0x9B, 0x6B, 0x54,
      0x62, 0x85, 0x78, 0xB6, 0x0C, 0x26, 0x99, 0x68, 0x33, 0x6F, 0xCE, 0xB8, 0x7F, 0xE7, 0xB0, 0x0F, 0x37,
      0x0C, 0x9E, 0x61, 0x0E, 0xF3, 0xC6, 0xAF, 0xAE, 0x20, 0xB0, 0x59, 0x59, 0xA1, 0x5C, 0xB7, 0x39, 0xB4,
      0xA5, 0x64, 0x6A, 0xAA, 0x03, 0xD9, 0xE0, 0xDF, 0x56, 0x71, 0x46, 0xCD, 0x62, 0x51, 0x4E, 0x33, 0xF3,
      0x6C, 0x65, 0xFD, 0xB9, 0xF1, 0x43, 0xF0, 0x1F, 0xD8, 0x72, 0xA5, 0xF9, 0x0A, 0x0C, 0xAA, 0x92, 0x91,
      0xEE, 0x1E, 0x2B, 0xB1, 0x39, 0xB0, 0x30, 0x81, 0xD7, 0x4D, 0x04, 0x19, 0xF0, 0x7C, 0x62, 0x62, 0xC3,
      0x24, 0xD0, 0x18, 0xD0, 0x8C, 0x06, 0x95, 0xC7, 0xF6, 0xC9, 0x79, 0x79, 0x8F, 0x31, 0x07, 0x95, 0x35,
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      0xF3, 0xD9, 0xDE, 0x62, 0x59, 0x5F, 0xB0, 0x5E, 0x5C, 0x21, 0xAA, 0x5A, 0x62, 0x44, 0xC2, 0x88, 0x1D,
      0x4C, 0x58, 0x45, 0x9B, 0x7C, 0xD5, 0xA1, 0xE1, 0x0E, 0xB7, 0x76, 0x48, 0x11, 0x27, 0xEE, 0x6E, 0x3C,
      0xF2, 0x01, 0x36, 0x50, 0x39, 0x2B, 0x76, 0x6D, 0x45, 0xA7, 0xCB, 0x84, 0x3E, 0x90, 0x11, 0x95, 0x56,
      0xB6, 0x5C, 0x60, 0xD1, 0x67, 0xD3, 0x9B, 0xED, 0xA3, 0xDD, 0x3A, 0x22, 0x6A, 0xB8, 0x80, 0x0F, 0x5D,
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      0x4C, 0x6C, 0x93, 0x80, 0xC8, 0x2C, 0x69, 0x82, 0xB7, 0x9D, 0x98, 0x60, 0x59, 0xFB, 0xF9, 0xAB, 0xBC,
      0x2C, 0xC0, 0xDD, 0x4D, 0x9B, 0x0B, 0x5E, 0x03, 0x92, 0x1F, 0xB4, 0xDC, 0xC6, 0x33, 0xDA, 0x66, 0x17,
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      0xB9, 0x91, 0xDA, 0x5A, 0xAB, 0xA8, 0x12, 0x4D, 0xFA, 0x4D, 0x0A, 0xAC, 0xD3, 0x95, 0x54, 0x78, 0x9F,
      0xAE, 0xC6, 0x35, 0x59, 0xAA, 0xB1, 0x07, 0x7B, 0x39, 0xAD, 0x62, 0xB3, 0x59, 0x1E, 0x0A, 0xA6, 0x52,
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      0xC1, 0xBC, 0x1E, 0x8D, 0x16, 0x7B, 0x5C, 0x7E, 0x45, 0xA4, 0x09, 0x63, 0xD6, 0xC7, 0x1C, 0x3D, 0x2C,
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      0x1D, 0xC3, 0x17, 0xA7, 0x5B, 0xDA, 0x4E, 0x79, 0xB0, 0xDC, 0xFA, 0x70, 0x33, 0xDB, 0x8B, 0x30, 0x23,
      0x2F, 0x49, 0xE2, 0x3B, 0x35, 0x33, 0x8C, 0xC0, 0xB4, 0x42, 0x54, 0x01, 0x4F, 0x37, 0xCB, 0x0D, 0xCE,
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      0xD5, 0xDC, 0x24, 0x62, 0x35, 0xBC, 0xF0, 0x42, 0xBC, 0xC5, 0xA2, 0x58, 0x3F, 0x6B, 0x6D, 0xAB, 0x1B,
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      0xE4, 0x1A, 0xAF, 0xD6, 0x92, 0x5F, 0x68, 0x02, 0xF4, 0xC3, 0xE3, 0x75, 0x1F, 0x3F, 0x1B, 0x5D, 0x9D,
      0x7D, 0x38, 0x3F, 0xBB, 0x3A, 0xEA, 0xFA, 0x81, 0x0C, 0xB6, 0x0B, 0x2D, 0x62, 0xD9, 0xE5, 0xA5, 0x3D,
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      0xAD, 0x7D, 0x91, 0x42, 0x97, 0x8F, 0xDC, 0xD1, 0x2E, 0x80, 0x8B, 0xDE, 0x8C, 0x92, 0x9F, 0x63, 0x9A,
      0x92, 0x39, 0x43, 0xB6, 0x8C, 0xD4, 0xBC, 0x44, 0x2B, 0xAF, 0xB5, 0x54, 0x01, 0x4E, 0xC2, 0x38, 0xA5,
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      0xA5, 0xDE, 0xCC, 0x18, 0x74, 0x92, 0x50, 0x72, 0x1F, 0xAF, 0x60, 0x5F, 0x27, 0x3E, 0xDC, 0x41, 0x04,
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      0x2F, 0x8A, 0xE2, 0x8C, 0x8C, 0x29, 0xF6, 0x02, 0x8B, 0x0D, 0x8B, 0x2D, 0x2F, 0xA0, 0xC2, 0xBD, 0xB2,
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      0x7F, 0x23, 0x63, 0xB2, 0x30, 0x48, 0x68, 0x17, 0xD1, 0x68, 0xA0, 0x2E, 0x65, 0x66, 0xE3, 0xCB, 0xB8,
      0xC2, 0x26, 0x0A, 0x53, 0xA2, 0xF8, 0xF1, 0x1A, 0xD3, 0x40, 0x65, 0x96, 0x23, 0x26, 0xD7, 0x85, 0xE5,
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      0x14, 0x03, 0x46, 0x97, 0x5E, 0xE2, 0x2D, 0xF0, 0xEC, 0xE2, 0xA8, 0x0B, 0xDF, 0xAC, 0xDD, 0x72, 0xC7,
      0x65, 0xEA, 0x03, 0x4F, 0x95, 0x09, 0xB0, 0x9F, 0x86, 0xCA, 0x51, 0xC6, 0x5E, 0x5F, 0xB6, 0x26, 0x9B,
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      0x2E, 0x25, 0x59, 0xB0, 0xA0, 0x09, 0xC3, 0x83, 0x08, 0x6B, 0x4D, 0xEE, 0x69, 0xC6, 0x90, 0x90, 0x44,
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      0xBB, 0x02, 0xC8, 0x74, 0xA6, 0xEA, 0x3B, 0x2F, 0x73, 0x85, 0xCE, 0xF9, 0x44, 0x41, 0x11, 0x7E, 0x90,
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      0xF1, 0x96, 0xD7, 0x75, 0x1B, 0x3B, 0x92, 0x04, 0x5B, 0xA3, 0x5F, 0xE0, 0xC5, 0xCB, 0xF7, 0xF3, 0x38,
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      0xE4, 0x94, 0xC0, 0x9E, 0x02, 0x0F, 0xD2, 0x1C, 0xD2, 0xB5, 0xE3, 0x8D, 0xB3, 0x15, 0x38, 0xBF, 0x87,
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      0xED, 0xAA, 0x0C, 0xA4, 0x24, 0x36, 0x9A, 0x74, 0xE4, 0x71, 0x5D, 0x49, 0x32, 0xCA, 0x41, 0x5E, 0x85,
      0x58, 0xE0, 0xD5, 0xA3, 0x8C, 0x19, 0xBB, 0x2A, 0xC1, 0x80, 0x5E, 0x69, 0xA0, 0xC4, 0x8E, 0xE4, 0xEA,
      0xAA, 0x5E, 0x3A, 0xC4, 0x40, 0x03, 0xAB, 0xF3, 0x96, 0x66, 0xCC, 0xFE, 0x1D, 0x24, 0xF1, 0x1B, 0xEC,
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      0x71, 0x9B, 0xA1, 0xA0, 0x7E, 0x09, 0x8F, 0xF0, 0x7E, 0x5C, 0x1D, 0xFA, 0x27, 0xA7, 0xA7, 0x67, 0x57,
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      0x17, 0xCB, 0xEC, 0x9E, 0xA9, 0x00, 0xEE, 0xD1, 0xB6, 0x75, 0x02, 0xED, 0xF1, 0x11, 0xA7, 0xB7, 0x93,
      0xC5, 0xB3, 0x59, 0x48, 0xD7, 0xCC, 0x2E, 0x3D, 0x2C, 0xBC, 0x27, 0xBB, 0x0B, 0x0C, 0x22, 0x78, 0xCD,
      0x1A, 0x72, 0x2C, 0xDA, 0x2D, 0xDE, 0xBF, 0xB5, 0xAD, 0x8A, 0x04, 0x5A, 0xDE, 0xDC, 0x08, 0xE6, 0xBB,
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      0x58, 0x59, 0xCA, 0x8B, 0xC7, 0x5E, 0x66, 0x4B, 0x21, 0x10, 0x30, 0x68, 0x4D, 0xC9, 0x95, 0x7B, 0x4B,
      0xDD, 0x7F, 0x2B, 0x3E, 0x7C, 0x13, 0x4D, 0x5B, 0xFC, 0x96, 0x65, 0x06, 0x5D, 0x7B, 0xF7, 0xB7, 0xEB,
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      0x7E, 0x48, 0xEF, 0x82, 0x6C, 0x32, 0x27, 0x0B, 0xE0, 0x41, 0x0C, 0xDB, 0x6E, 0x56, 0x9D, 0x4C, 0xA7,
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      0x40, 0xFC, 0x9B, 0xD8, 0xDD, 0x35, 0x1C, 0xB3, 0xC4, 0xE7, 0x8D, 0xCD, 0xED, 0xAE, 0x41, 0xE8, 0x41,
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      0xE5, 0x6B, 0xD1, 0xEA, 0xA2, 0xBC, 0xDF, 0xE1, 0x3B, 0x67, 0x5A, 0x04, 0x04, 0x8B, 0xA1, 0xD7, 0xE2,
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      0x24, 0xAF, 0x00, 0x36, 0xCA, 0x96, 0x8D, 0x34, 0x76, 0x9B, 0xEC, 0xBB, 0x92, 0xD7, 0x8C, 0x44, 0xD6,
      0xEB, 0x8D, 0x00, 0xF2, 0x01, 0x81, 0x30, 0x62, 0x05, 0x58, 0x06, 0x15, 0x69, 0x2D, 0xF5, 0x58, 0x93,
      0xBA, 0x65, 0xD4, 0x17, 0xFE, 0x4B, 0x7C, 0x6B, 0x46, 0xFC, 0xB4, 0x0A, 0xC2, 0x0C, 0xCD, 0xF1, 0x90,
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      0x8C, 0xCB, 0x01, 0xD9, 0x7F, 0xD2, 0x84, 0x9D, 0xFD, 0x90, 0xDB, 0xBE, 0xDB, 0x73, 0x77, 0x5F, 0x60,
      0x6A, 0x02, 0x5F, 0x2F, 0xD3, 0x1B, 0xEC, 0x75, 0x7A, 0x07, 0x9D, 0xC1, 0x4B, 0x72, 0x1D, 0xE0, 0x6F,
      0xD8, 0xF6, 0x0F, 0x86, 0xBB, 0xF0, 0xBF, 0x1E, 0xF9, 0x39, 0x60, 0xB7, 0x3E, 0x82, 0xE8, 0xCB, 0xEE,
      0x0B, 0xFA, 0xF2, 0xD5, 0x94, 0x96, 0xE1, 0xFD, 0x14, 0x70, 0xBD, 0x63, 0x05, 0x47, 0x36, 0x14, 0x3A,
      0x62, 0xB2, 0x0E, 0x4E, 0xD3, 0x3B, 0x18, 0xBC, 0xEC, 0xF4, 0x0F, 0x76, 0x0F, 0x76, 0x7B, 0x1D, 0x84,
      0xDB, 0x11, 0x70, 0xD1, 0x3A, 0x6F, 0xE5, 0x26, 0x63, 0x4D, 0xE3, 0x51, 0x3A, 0x49, 0x82, 0xA5, 0x14,
      0x7C, 0x76, 0xBB, 0xA0, 0x9B, 0x11, 0x4D, 0x82, 0x09, 0x61, 0xA6, 0x33, 0xA5, 0x91, 0x4F, 0xD0, 0x0A,
      0xCA, 0x3D, 0xAE, 0xE0, 0x61, 0xCA, 0xDA, 0x53, 0xE2, 0xA5, 0x04, 0xCD, 0x2A, 0x61, 0x11, 0x49, 0x9A,
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      0xA5, 0x25, 0xD5, 0xD9, 0xB3, 0x21, 0x2E, 0xFC, 0xF7, 0xCC, 0x9B, 0xCC, 0xDB, 0x0C, 0xA1, 0xE3, 0x91,
      0x56, 0xCA, 0x9F, 0x2C, 0x5C, 0xCF, 0xF7, 0xCF, 0x6E, 0x01, 0xE6, 0xDB, 0x00, 0x94, 0x39, 0x42, 0xB1,
      0xE3, 0xF6, 0x15, 0x24, 0x62, 0xBA, 0x8A, 0x78, 0x91, 0x6B, 0x9B, 0xDE, 0xB2, 0xBB, 0xA5, 0xFA, 0x8D,
      0x7F, 0xD6, 0xE0, 0x2E, 0x13, 0xF6, 0xAF, 0xA8, 0x10, 0x87, 0x4D, 0xE6, 0x96, 0xE1, 0x97, 0x88, 0x73,
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      0xB0, 0x9F, 0xC7, 0xA6, 0x2E, 0xE8, 0x44, 0xDB, 0xC1, 0xCE, 0x2C, 0x61, 0x35, 0x24, 0xCE, 0x4E, 0x01,
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      0xB0, 0xC0, 0x54, 0xEB, 0xF2, 0x6D, 0xDB, 0xC5, 0x84, 0x6C, 0x1B, 0xF4, 0x6D, 0x09, 0x28, 0x53, 0x7D,
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      0xE8, 0x2A, 0xFB, 0x6E, 0x64, 0x99, 0xF2, 0x2B, 0xD4, 0xD2, 0x65, 0x1F, 0x59, 0xFA, 0xC1, 0x36, 0x89,
      0xE0, 0x49, 0xDC, 0x2D, 0x90, 0x7F, 0x05, 0xFA, 0xD6, 0xCB, 0x43, 0x76, 0xD1, 0x28, 0x99, 0xA2, 0xEA,
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      0xE7, 0x25, 0xB4, 0x9F, 0x13, 0x67, 0x64, 0x1F, 0x57, 0xD0, 0x5F, 0x01, 0xB9, 0xBB, 0x54, 0x01, 0x28,
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      0xCB, 0x67, 0xD3, 0x2C, 0x3D, 0x1F, 0x61, 0xF0, 0x7E, 0xB8, 0xD2, 0x65, 0xDF, 0x67, 0x59, 0xF7, 0xB5,
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      0x2B, 0xBA, 0xFC, 0xD8, 0x2D, 0x19, 0xD3, 0xBC, 0x24, 0xE2, 0xA7, 0xAC, 0xCA, 0x2C, 0x6B, 0x85, 0x12,
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      0x0C, 0xBE, 0xD4, 0x49, 0x4F, 0x51, 0x8E, 0x60, 0xB4, 0xE5, 0x4A, 0xB9, 0x87, 0xFE, 0x13, 0x12, 0xEB,
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      0x7E, 0x3E, 0xBB, 0x06, 0x07, 0xE6, 0x74, 0x41, 0xC4, 0xD8, 0x92, 0xEE, 0x30, 0xC6, 0x9A, 0xBA, 0x47,
      0x58, 0x86, 0x8E, 0xCA, 0x59, 0xC4, 0xBA, 0xB6, 0x1D, 0x29, 0xBE, 0x1D, 0x41, 0xDE, 0x8D, 0x82, 0x29,
      0xDA, 0x23, 0x7F, 0xFE, 0x33, 0x7B, 0x6B, 0x82, 0xCB, 0x6F, 0x64, 0xE3, 0xB3, 0x01, 0x70, 0xC9, 0xB2,
      0x29, 0x45, 0x5A, 0xF0, 0xB8, 0xFF, 0x43, 0x91, 0x18, 0x65, 0x27, 0x5D, 0xEE, 0xD2, 0x4B, 0x52, 0x9A,
      0xC3, 0xE7, 0x4D, 0xD7, 0xFA, 0xCF, 0x75, 0x19, 0x79, 0xC8, 0xE5, 0x7A, 0xC2, 0xAE, 0x04, 0xF3, 0xD4,
      0x1C, 0xCB, 0x22, 0xCB, 0xB3, 0x58, 0xC0, 0x20, 0x49, 0x72, 0x37, 0x37, 0xA4, 0xD1, 0x2C, 0x9B, 0x93,
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      0x2F, 0xCB, 0xD3, 0x73, 0x55, 0xEA, 0x9F, 0xBC, 0xE7, 0x73, 0xAE, 0x70, 0xB9, 0x82, 0xF1, 0x97, 0x86,
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      0x70, 0x58, 0x72, 0x9D, 0xC0, 0xBA, 0x16, 0xD6, 0xA3, 0x41, 0x3A, 0xCC, 0x64, 0x3B, 0x45, 0x4E, 0xBF,
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      0xC4, 0x20, 0xFE, 0x53, 0x82, 0x22, 0x7C, 0xAA, 0xDC, 0x9F, 0x31, 0xD7, 0x65, 0x9D, 0xF3, 0xB8, 0x62,
      0x4E, 0xDD, 0xD1, 0xE4, 0x07, 0x63, 0xA7, 0xC8, 0x4D, 0xE1, 0x6A, 0x04, 0x44, 0xD8, 0x36, 0x85, 0xE9,
      0xA7, 0xDE, 0x67, 0x76, 0xC6, 0x75, 0xCA, 0x5F, 0x58, 0x68, 0x10, 0xAA, 0x75, 0x24, 0xE8, 0xF2, 0xDF,
      0x0B, 0x38, 0xAE, 0x02, 0x60, 0x0D, 0x96, 0x95, 0x13, 0x1E, 0xF1, 0xCE, 0x9B, 0x37, 0x1F, 0xDF, 0x9F,
      0x62, 0x68, 0x7C, 0x55, 0x0E, 0x3E, 0x99, 0x6B, 0xE6, 0x47, 0x26, 0xA8, 0x7B, 0x28, 0xB0, 0xBD, 0x43,
      0x43, 0x17, 0x6C, 0x7C, 0x57, 0x9B, 0x27, 0x31, 0xBC, 0x7C, 0x65, 0xFB, 0xB0, 0x7A, 0xC2, 0x53, 0x2F,
      0x34, 0x5A, 0x0E, 0xE5, 0xBC, 0xE7, 0xAA, 0xC0, 0x22, 0xD1, 0xF4, 0x48, 0xC3, 0xB0, 0x6C, 0xDA, 0xD8,
      0x4D, 0xB7, 0xFC, 0xF5, 0x2F, 0x68, 0xC9, 0x75, 0xA2, 0xC1, 0x86, 0x13, 0x71, 0x9F, 0x95, 0x78, 0xB3,
      0x58, 0x0D, 0xFC, 0xD4, 0xFE, 0xCF, 0x9F, 0x5B, 0x23, 0x43, 0x0D, 0x5B, 0xCD, 0x74, 0x7D, 0xDB, 0xAA,
      0xA6, 0xB1, 0x6D, 0xDA, 0x5D, 0x3E, 0x2E, 0xCA, 0x63, 0x70, 0xFF, 0xE7, 0xC6, 0x79, 0x9C, 0x6F, 0x0C,
      0x4C, 0x65, 0xA4, 0x67, 0x84, 0xB4, 0x3E, 0x03, 0x45, 0xFB, 0x24, 0x48, 0x60, 0x1B, 0x35, 0x2B, 0xFA,
      0x42, 0xDE, 0xB0, 0xCF, 0x4F, 0x78, 0x01, 0xA1, 0x56, 0x1F, 0xD6, 0x6F, 0x56, 0xB2, 0x90, 0xA3, 0x40,
      0xD4, 0x42, 0xC7, 0xCA, 0xA8, 0xF1, 0x86, 0xDE, 0x63, 0x2D, 0x69, 0x89, 0xD8, 0x0A, 0x2F, 0xAB, 0xC5,
      0xB6, 0x73, 0x2F, 0xBD, 0xB8, 0x8B, 0x2E, 0xC5, 0x8F, 0x70, 0xB4, 0x01, 0xDC, 0x76, 0xB3, 0x28, 0xB3,
      0x88, 0x12, 0x8F, 0xEA, 0xC3, 0x19, 0x53, 0x44, 0x85, 0x88, 0x37, 0x8C, 0x9E, 0x54, 0xA4, 0x3F, 0xC1,
      0xD8, 0xCF, 0x2E, 0x0B, 0x37, 0xEB, 0x70, 0x35, 0xCC, 0x9E, 0xC7, 0xA9, 0x88, 0x84, 0x05, 0x2A, 0x22,
      0x56, 0x1B, 0xC0, 0x2A, 0xA0, 0x75, 0x50, 0x98, 0xFD, 0x6E, 0x48, 0x61, 0x6D, 0x74, 0x54, 0x43, 0x8B,
      0x78, 0x35, 0x69, 0x6B, 0x64, 0x24, 0xAA, 0x31, 0x16, 0x4F, 0x1A, 0xC3, 0xDA, 0xC5, 0xFA, 0xE1, 0x51,
      0xEC, 0xB7, 0x0A, 0x05, 0xD2, 0xFC, 0x98, 0x75, 0x73, 0xF7, 0xCC, 0xE2, 0x87, 0xAA, 0x84, 0xC9, 0xEE,
      0xBA, 0xF4, 0xC4, 0x84, 0x7E, 0x2C, 0x55, 0x72, 0x60, 0x9B, 0xD4, 0xC9, 0x58, 0x9C, 0x8B, 0xC8, 0x39,
      0x7C, 0x9F, 0xD8, 0x57, 0x58, 0xD4, 0x8F, 0xC6, 0xC3, 0xCB, 0x3F, 0x24, 0xFE, 0xAD, 0xC4, 0xA0, 0x69,
      0x0C, 0xBC, 0x5E, 0xFF, 0xB2, 0x83, 0x2D, 0x07, 0x48, 0x1F, 0xF8, 0xCB, 0x70, 0x08, 0xAC, 0x26, 0xA0,
      0xB3, 0x00, 0xA5, 0x61, 0x27, 0xE2, 0xAB, 0x14, 0xF3, 0x2F, 0x1E, 0x77, 0x2B, 0xF1, 0xF8, 0xBF, 0xE8,
      0x24, 0xD3, 0x1D, 0xB7, 0x78, 0x91, 0xCE, 0xDF, 0x83, 0x6C, 0x8E, 0xFD, 0xFE, 0x13, 0xC3, 0xB6, 0x54,
      0x58, 0x2A, 0xD6, 0x82, 0xAE, 0x40, 0x33, 0x51, 0x66, 0xD3, 0x6D, 0xEF, 0x5F, 0xB6, 0x80, 0xEB, 0x7E,
      0x9B, 0x98, 0x6E, 0x8C, 0xE1, 0x45, 0xE4, 0x5D, 0x5D, 0x55, 0x88, 0xEF, 0xD3, 0x65, 0xB6, 0xD9, 0x22,
      0xA5, 0x39, 0x90, 0xA2, 0xCE, 0x50, 0x3C, 0xB0, 0x97, 0x2F, 0x15, 0xC7, 0x2F, 0xBC, 0x23, 0xEC, 0x1D,
      0x66, 0x45, 0x7C, 0xED, 0x9C, 0xBF, 0xBF, 0xFC, 0x78, 0xED, 0xD4, 0x19, 0x71, 0x79, 0x78, 0xA9, 0xA8,
      0xCF, 0xC1, 0x64, 0x33, 0x0C, 0x67, 0xB0, 0x8A, 0x6B, 0x4B, 0x4D, 0x7C, 0x82, 0x92, 0x16, 0xE5, 0xE9,
      0xB6, 0x3C, 0x21, 0xFD, 0x09, 0xA2, 0x07, 0x60, 0x01, 0x04, 0x50, 0x9F, 0x61, 0xFF, 0x22, 0x05, 0x13,
      0x6B, 0xE6, 0x33, 0xBB, 0xBA, 0x5D, 0xEF, 0x20, 0x72, 0xB4, 0xD7, 0xB9, 0x6E, 0x23, 0xA4, 0xC7, 0xD8,
      0xE5, 0x86, 0x9E, 0xC3, 0x48, 0x31, 0xDF, 0x69, 0xA0, 0x44, 0x7E, 0x07, 0x9A, 0xF3, 0x6D, 0xCC, 0x93,
      0x52, 0x6C, 0x6F, 0x61, 0x7C, 0xB0, 0x4A, 0xDA, 0xD5, 0xD9, 0xDB, 0xB3, 0xD3, 0x7A, 0x51, 0x33, 0x72,
      0x49, 0x5C, 0xAB, 0x7F, 0x42, 0x36, 0x95, 0x92, 0x7E, 0x3D, 0x9E, 0xF4, 0xCB, 0xD1, 0x16, 0x57, 0x64,
      0x36, 0xC9, 0xFB, 0xC9, 0x5C, 0x17, 0xC3, 0x3F, 0x05, 0x9F, 0xDD, 0xE2, 0xFD, 0x06, 0x95, 0x99, 0x99,
      0x66, 0x52, 0xC6, 0xE2, 0x7F, 0xD0, 0xB6, 0x78, 0x6A, 0x26, 0x98, 0xEF, 0x97, 0xC7, 0x71, 0x8C, 0x6F,
      0xC2, 0x69, 0x35, 0x41, 0x18, 0x13, 0x06, 0x10, 0x74, 0xB7, 0xD0, 0x7F, 0xB6, 0xC8, 0x02, 0x02, 0x65,
      0x7C, 0x39, 0x19, 0xC6, 0xE1, 0xD3, 0x20, 0x81, 0x2F, 0x9C, 0x90, 0x5A, 0x30, 0x26, 0xD3, 0xC8, 0x97,
      0xA0, 0x01, 0x0E, 0x26, 0xC6, 0xF5, 0x4A, 0x8C, 0xAB, 0xF6, 0xEE, 0x55, 0x62, 0x6F, 0x80, 0xCB, 0x9A,
      0xEA, 0xA1, 0x35, 0x8E, 0x06, 0x4D, 0xE8, 0xF7, 0xBF, 0x13, 0xFA, 0xFD, 0xE6, 0xE8, 0x3F, 0x4D, 0xA8,
      0xFB, 0x1D, 0x74, 0xE4, 0x49, 0xF4, 0xC4, 0xE4, 0x95, 0x24, 0x60, 0x82, 0x7F, 0xC7, 0x16, 0xBB, 0xD7,
      0x14, 0xCD, 0x7A, 0x54, 0x9B, 0x2F, 0x6D, 0x93, 0xE5, 0x0D, 0x1A, 0x2F, 0x6F, 0x51, 0xEB, 0x9E, 0x50,
      0xEF, 0xA6, 0x59, 0xF7, 0x6F, 0x8F, 0x95, 0x99, 0xAD, 0x87, 0xFA, 0x83, 0x6A, 0x66, 0x83, 0x09, 0xFA,
      0xC5, 0x8B, 0xFC, 0x90, 0xF2, 0x7D, 0x14, 0xC1, 0x53, 0xD6, 0x59, 0xC4, 0xE2, 0x99, 0x2C, 0x8E, 0xB7,
      0x1E, 0x64, 0x76, 0x3E, 0x39, 0x0C, 0x96, 0xF3, 0x79, 0x13, 0xA3, 0xCD, 0x86, 0x70, 0x67, 0x45, 0xAA,
      0xA1, 0x1E, 0x3E, 0xDC, 0x20, 0x7E, 0x72, 0xF0, 0xED, 0xE6, 0x1B, 0xDB, 0x45, 0x39, 0x1D, 0x51, 0x05,
      0xF7, 0x0F, 0x33, 0x0C, 0x46, 0x1F, 0xBD, 0xC6, 0xF2, 0x3B, 0x44, 0x32, 0xB5, 0x2C, 0x78, 0xDA, 0x68,
      0xE6, 0x5B, 0xFD, 0x9E, 0xCB, 0x52, 0xD9, 0xC2, 0x6F, 0x21, 0xF2, 0x5D, 0x0B, 0xD7, 0xF4, 0x3B, 0x7C,
      0xE9, 0x8F, 0x74, 0x28, 0x5F, 0x6C, 0x5E, 0x30, 0x90, 0x8E, 0xB0, 0xC0, 0x05, 0x2F, 0x0B, 0xF2, 0x71,
      0x4F, 0x9C, 0x7C, 0x9C, 0x4C, 0x67, 0x30, 0x09, 0xBB, 0xC5, 0xFD, 0xEF, 0x91, 0x7D, 0xCC, 0xB4, 0xDF,
      0xB4, 0x7B, 0xFA, 0xDC, 0xE4, 0x37, 0xC2, 0x2E, 0x75, 0x10, 0x7E, 0xAB, 0x63, 0xBB, 0xF1, 0x45, 0x12,
      0x1D, 0x7E, 0xC3, 0x81, 0x0E, 0x37, 0x5A, 0x7C, 0xF3, 0xF9, 0x26, 0x89, 0x17, 0x7F, 0xE5, 0x0C, 0x17,
      0xBB, 0x69, 0xC4, 0x1E, 0xF5, 0x03, 0x29, 0xE3, 0x75, 0x57, 0x33, 0xA6, 0x12, 0xB6, 0xDB, 0x23, 0x15,
      0xE6, 0xB6, 0xA4, 0x77, 0xB2, 0xA4, 0x6D, 0x7A, 0xC0, 0x5E, 0xB5, 0x6F, 0xB6, 0x0E, 0x7C, 0x4C, 0x6A,
      0xA3, 0x9A, 0x45, 0x33, 0x61, 0x42, 0x24, 0x16, 0xFD, 0x91, 0x59, 0x8F, 0x47, 0x23, 0xD7, 0x30, 0x21,
      0xA2, 0x2D, 0xE1, 0x09, 0x9B, 0x18, 0x81, 0xB3, 0x55, 0x64, 0xB7, 0xF4, 0xB2, 0x98, 0x57, 0xC7, 0x95,
      0xAA, 0x4D, 0x24, 0x79, 0x30, 0x5A, 0x0D, 0x29, 0xA3, 0xC2, 0x8A, 0x56, 0xD7, 0x97, 0x90, 0x81, 0x17,
      0xBF, 0x7F, 0x33, 0xDA, 0x1E, 0xF9, 0xD6, 0x33, 0x3F, 0xE7, 0x0A, 0x7C, 0x62, 0x2A, 0xCC, 0x5C, 0x9F,
      0xD2, 0x61, 0x87, 0xE3, 0x8A, 0xDA, 0x4D, 0x99, 0xA9, 0xE5, 0x19, 0x86, 0xF9, 0x29, 0x21, 0x5E, 0x55,
      0x4B, 0x97, 0x74, 0x12, 0x4C, 0x03, 0xC3, 0xA5, 0x8D, 0xFF, 0xB5, 0x7D, 0xFF, 0xDD, 0x6C, 0x5F, 0x79,
      0x99, 0xFF, 0xBD, 0xAD, 0x1E, 0xE6, 0xE0, 0xB0, 0xDB, 0x55, 0x96, 0x20, 0x6A, 0x82, 0xC3, 0x29, 0xFB,
      0x16, 0x4C, 0xEF, 0x4B, 0xF6, 0x6F, 0x87, 0xFD, 0x02, 0xCD, 0x34, 0x00, 0xF0, 0x3B, 0x64, 0x60, 0x01,
      0x68, 0x3B, 0x77, 0xCA, 0xB5, 0x65, 0x5B, 0xA9, 0x89, 0x5B, 0x26, 0x74, 0xF4, 0x7F, 0xA3, 0xA3, 0x49,
      0xEC, 0x53, 0x3C, 0x27, 0xB0, 0xF2, 0x58, 0x42, 0xD2, 0xDE, 0xC9, 0x39, 0xEA, 0x32, 0x40, 0x00, 0xB0,
      0x8B, 0x80, 0x9D, 0xA7, 0xB5, 0xD8, 0xB6, 0x85, 0xFD, 0x17, 0xDB, 0xEA, 0x47, 0xA0, 0xF5, 0x50, 0x2B,
      0x9D, 0xD7, 0x02, 0x32, 0x99, 0xC3, 0x17, 0x25, 0xCE, 0xE3, 0x3B, 0xC7, 0xF4, 0xF3, 0x6A, 0xE2, 0x72,
      0xFA, 0x51, 0x97, 0xBF, 0x62, 0x0C, 0x7F, 0x68, 0x2D, 0x5B, 0x84, 0xA3, 0xFF, 0x0F, 0x62, 0x8E, 0xDA,
      0x76, 0x2E, 0xBA, 0x00, 0x00
}
```

HTML_GZ_PROGMEM array containing the gzipped version of the webpage from the python preprocessor.

6.16 lib/comms_handler/src/configwebpage/webpage/webpage.h File Reference

Variables

- const size_t HTML_GZ_PROGMEM_LEN

  Length variable for the HTML_GZ_PROGMEM array.
- const uint8_t HTML_GZ_PROGMEM[ ] PROGMEM

  HTML_GZ_PROGMEM array containing the gzipped version of the webpage from the python preprocessor.

6.16.1 Variable Documentation

6.16.1.1 HTML_GZ_PROGMEM_LEN

```
const size_t HTML_GZ_PROGMEM_LEN  [extern]
```

Length variable for the HTML_GZ_PROGMEM array.

6.16.1.2 PROGMEM

```
const uint8_t HTML_GZ_PROGMEM [ ] PROGMEM  [extern]
```

HTML_GZ_PROGMEM array containing the gzipped version of the webpage from the python preprocessor.

6.17 webpage.h

Go to the documentation of this file.

```

#ifndef WEBPAGE_GZIP_H
#define WEBPAGE_GZIP_H

extern const size_t HTML_GZ_PROGMEM_LEN;

extern const uint8_t HTML_GZ_PROGMEM[] PROGMEM;

#endif
```

6.18 lib/comms_handler/src/ota/otahelper.cpp File Reference

```
#include "otahelper.h"
#include <Arduino.h>
#include <ArduinoJson.h>
#include <esp_log.h>
#include <Update.h>
#include <version.h>
```

6.19 lib/comms_handler/src/ota/otahelper.h File Reference

```
#include "config/confighelper.h"
#include <HTTPClient.h>
#include <ArduinoJson.h>
#include <Arduino.h>
#include <freertos/FreeRTOS.h>
#include <A76XX.h>
```

Classes

- class OTAHelper

6.20 otahelper.h

Go to the documentation of this file.

```
#ifndef OTA_HELPER_H
#define OTA_HELPER_H

#include "config/confighelper.h"
#include <HTTPClient.h>
#include <ArduinoJson.h>
#include <Arduino.h>
#include <freertos/FreeRTOS.h>
#include <A76XX.h>

class OTAHelper
{
public:
    enum OTAMethod_t
    {
        OTA_WIFI,
        OTA_LTE
    };

    OTAHelper(A76XX *a76xx);

    bool CheckUpdateJSON(String server, OTAHelper::OTAMethod_t method = OTAHelper::OTA_WIFI);

    bool CheckOTAHasMessage();
    bool GetOTAMessage(String &message);
    void ClearOTAMessageStrings();

    bool CheckJSONForNewVersion(bool str_msg = true);

    void handleOTAChunks(String filename, size_t index, uint8_t *data, size_t len, bool final, size_t reqlen = 0, bool str_msg = true);
    void CallOTAInternetUpdateAsync(String url = "", bool autorestart = false, bool str_msg = true);
    static void UpdateOTAInternetURL(void *pvParameters);
    void UpdateOTAFileUpload();

    void AddToUpdateString(String update_msg);
    void AddToErrorString(String error_msg);

    bool _str_msg = true;

    String _server_json_url;
    String _update_url;
    int server_port;
    bool _update_success = false;

    bool _auto_restart = false;
    String _error_msg;
    String _update_msg;

    bool _update_running = false;
    JsonDocument _update_meta_json;
    A76XX *_a76xx = nullptr;
    A76XXHTTPClient *_a76xx_http = nullptr;
    HTTPClient *_wifi_http;

    ConfigHelper *_config_helper;


};

#endif // OTA_HELPER_H
```

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