



STORMSHIELD



TECHNICAL NOTE

STORMSHIELD NETWORK SECURITY

IDENTIFYING INDUSTRIAL PROTOCOL COMMANDS GOING THROUGH THE FIREWALL

Product concerned: SNS 3 and higher versions

Date: October 3, 2018

Reference: [sns-en-identifying_industrial_protocol_commands_technical_note](#)



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Introduction

Most of the time, industrial protocols are designed for a functional purpose, without necessarily taking into account security aspects.

In general, they allow client machines to request actions from PLCs (Programmable Logic Controllers), expecting such actions to be run in return. Client workstations may as such ask a PLC to write data in memory or simply order it to shut down.

Such requests for action are defined in a particular field of the protocol called the "function code". As industrial protocols do not include any security mechanisms such as the verification of the message sender's identity, any machine on the network would then be able to request actions from the PLC.

The aim of this document is to set out a method that would allow identifying a protocol's various function codes exchanged over the corporate industrial network. After this capture, the administrator would be able to build up a security policy adapted to the function codes to be allowed or prohibited for each machine found on the network.

Therefore, suspicious machines located on the network would not be able to send messages to the PLC as the Stormshield Network Firewall would filter them.

Requirements

SNS firewall in version 2.3.4 or higher.

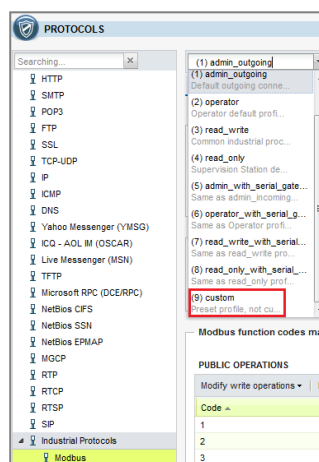


Creating a customized inspection profile

Create a customized inspection profile for the selected industrial protocol (Modbus in the example). In this profile, all function codes will be configured to generate an alarm allowing the identification of codes going through the network. This inspection profile will then be used in the filter policy.

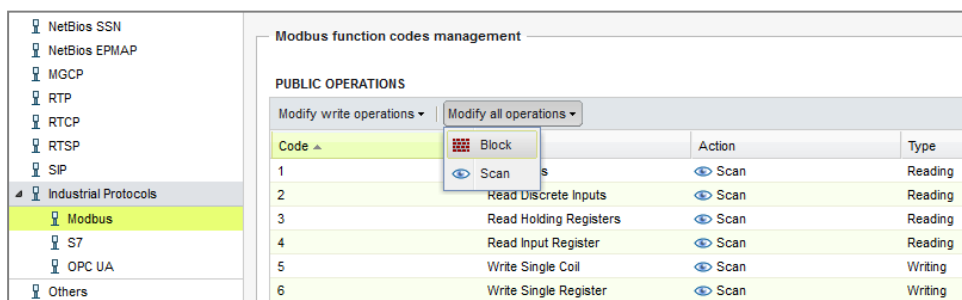
Selecting the Modbus protocol profile

1. In the **Configuration > Application protection > Protocols** menu, select the Modbus protocol (*Industrial protocols* section):
2. Select the protocol profile **(9) custom**:



Prohibiting all public Modbus operations

1. In the table listing all public Modbus operations, browse the menu **Modify all operations**, and select **Block**. This action would result in an alarm being raised every time a Modbus function code is detected:



2. Confirm by clicking on **Apply**.

Customizing the application inspection profile

1. In the **Configuration > Application protection > Inspection profile** menu, click on **Go to profiles**.
2. Select the profile **(9) IPS_09** (by default, this inspection profile will use no. 9 protocol profiles):



INSPECTION PROFILE

SECURITY INSPECTION

(9) IPS_09 | Edit | Go to global configuration

Configuration

APPLICATION PROFILES ASSOCIATED WITH THIS INSPECTION PROFILE

Protocol - Application	Application profile
HTTP	(9) http_09
SMTP	(9) smtp_09
POP3	(9) pop3_09
FTP	(9) ftp_09

- Expand the **Edit** menu and select **Rename** in order to customize the name of this inspection profile:

INSPECTION PROFILE

SECURITY INSPECTION

(9) IPS_09 | Edit | Go to global configuration

Configuration

APPLICATION PROFILES ASSOCIATED WITH THIS INSPECTION PROFILE

Protocol - Application	Application profile
HTTP	(9) http_09
SMTP	(9) smtp_09
POP3	(9) pop3_09
FTP	(9) ftp_09

- Choose a representative name (*IPS_Network_Discovery* in the example) and confirm the change by clicking on **Update**:

Rename profile: (9) IPS_09

Name : IPS_Network_Discovery

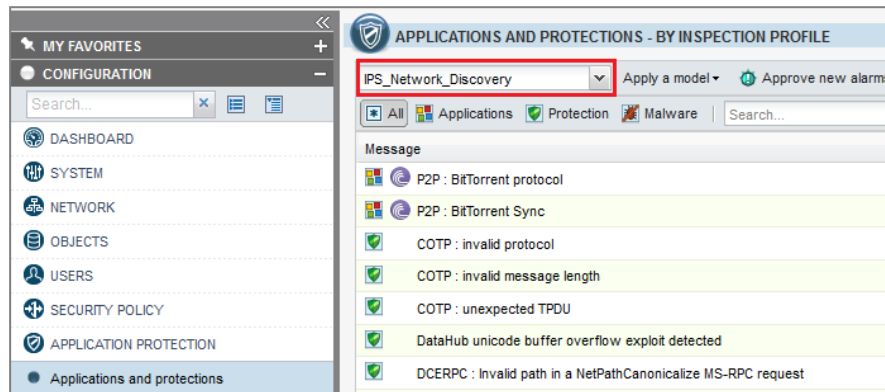
Comments :

Update Cancel

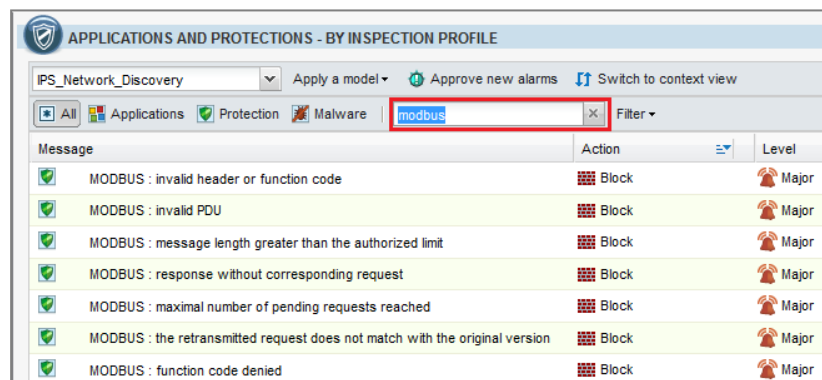


Modifying the action of the "Function code denied" alarm

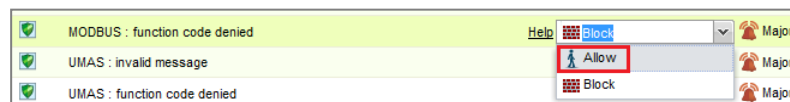
1. In the **Configuration > Application protection > Applications and protections** menu, select the customized inspection profile created earlier:



2. Enter the name of the industrial protocol to be filtered in the search field. All alarms relating to this protocol will appear:



3. Locate the "function code denied" alarm and modify its action by double-clicking on *Block*. Select *Allow*:



4. Confirm the change by clicking on **Apply**.



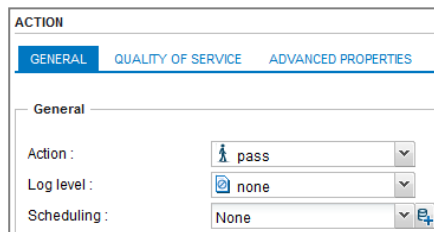
Creating a filter rule using the customized inspection profile

The aim of this rule is to allow all function codes from the selected industrial protocol (Modbus in this document) while systematically generating an alarm in order to identify them in the firewall's logs.

NOTE

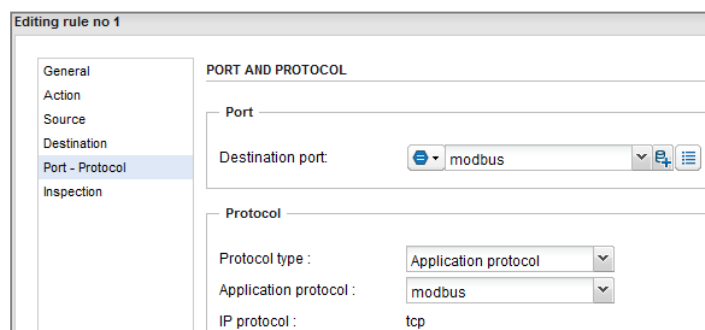
While this rule is temporary, it needs to be placed at the top of the active filter policy.

1. In the **Configuration > Security policy > Filter - NAT** menu, select the active filter slot (slot [9] Filter 09 in the example), then click on **New rule** and select **Simple rule**.
2. In the Status column, double-click on **Off** to enable the rule (the status of the rule becomes **On**).
3. In the **Action** column, double-click on *block* then select the value *pass* for the **Action** field:



ACTION		
GENERAL	QUALITY OF SERVICE	ADVANCED PROPERTIES
General		
Action :	pass	
Log level :	none	
Scheduling :	None	

4. In the **Port - Protocol** section located to the left of the rule editing window, assign the following values to the various fields:
 - **Destination port:** modbus
 - **Protocol type:** Application protocol,
 - **Application protocol:** modbus



Editing rule no 1	
General	PORT AND PROTOCOL
Action	
Source	
Destination	
Port - Protocol	
Inspection	
Port	
Destination port :	modbus
Protocol	
Protocol type :	Application protocol
Application protocol :	modbus
IP protocol :	tcp



5. In the **Inspection** section, select the inspection profile that was renamed earlier *[(9)IPS_Network_Discovery]* in the example):

General
Action
Source
Destination
Port - Protocol
Inspection

SECURITY INSPECTION

General

Inspection level : IPS

Inspection profile :
Depending on traffic direction

Application inspection

Antivirus :
Sandboxing :
Antispam :
HTTP Cache :
URL filtering :
SMTP filtering :
FTP filtering :
SSL filtering :

(00) IPS_00
Default INCOMING config: u...
(01) IPS_01
Default OUTGOING config: ...
(02) IPS_02
(03) IPS_03
(04) IPS_04
(05) IPS_05
(06) IPS_06
(07) IPS_07
(08) IPS_08
(09) IPS_Network_Discovery

6. Confirm the changes by clicking on **OK**. The filter rule will then look like this:

FILTERING		NAT					
Searched text							
+ New rule - X Delete Up Down Expand all Collapse all Cut Copy Paste Reset rules statistics							
	Status	Action	Source	Destination	Dest. port	Protocol	Security inspection
1	on	pass	Any	Any	modbus	MODBUS	IPS (IPS_Network_Discovery)

! IMPORTANT

If none of the security policies were enabled on the firewall, a second filter rule must be created to ensure that no traffic outside the Modbus protocol is blocked. This rule will be the last in the filter slot and will have the following values:

- **Status:** On,
- **Action:** pass,
- **Source:** Any,
- **Destination:** Any,
- **Destination port:** Any,
- **Protocol:** leave the field blank,
- **Security inspection:** select the *Firewall* mode.

The filter policy will then become:

FILTERING		NAT					
<div>Searched text</div> <div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></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7. Enable the filter policy by clicking on **Save and apply**.



Viewing generated alarms

Viewing alarms in the dashboard

In the **Dashboard** menu, the **Alarms** window will display in real time alarms that were raised when network packets from the industrial protocol go through the firewall:

ALARMS						
Date ▾	Action	Priority	Source	Destination	Message	
11:21:47 AM	Pass	Major	console_admin	plc	MODBUS : function code denied (6)	
11:21:47 AM	Pass	Major	console_admin	plc	MODBUS : function code denied (6)	
11:21:44 AM	Pass	Major	console_admin	plc	MODBUS : function code denied (3)	
11:21:43 AM	Pass	Major	console_admin	plc	MODBUS : function code denied (3)	
11:21:43 AM	Pass	Major	console_admin	plc	MODBUS : function code denied (6)	
11:21:40 AM	Pass	Major	console_admin	plc	MODBUS : function code denied (3)	
11:21:40 AM	Pass	Major	console_admin	plc	MODBUS : function code denied (3)	

Viewing alarms in the log and activity report application

View the alarms that the firewall has generated (**Logs > Alarms** menu), filtering by the name of the industrial protocol:

The screenshot shows the Stormshield web interface. On the left, a sidebar contains 'MY FAVORITES', 'TRACES', 'VIEWS', and 'LOGS'. Under 'LOGS', there are radio buttons for 'Administration' and 'Alarms'. The main content area is titled 'ALARMS' and features a search bar with the text 'modbus' entered. Above the search bar, there is a 'Last hour' filter and buttons for 'Refresh', 'Line view', and 'Expand'. Below the search bar, the search range is specified as 'SEARCH FROM - 04/13/2016 04:03:48 PM - TO - 04/13/2016 05:03:48 PM'.



Building a customized security policy

After having highlighted the function codes of the industrial protocol circulating on your network, you will now be able to implement an adapted security policy. The various steps that you need to follow are:

1. Choose a predefined protocol inspection profile or build a customized profile for the industrial protocol being considered.
2. Associate this protocol profile with an application inspection profile.
3. Modify the action associated with the "*function code denied*" alert to make it block such traffic.
4. Modify the filter rule dedicated to the industrial protocol in order to call up this application inspection profile.

Selecting the protocol inspection profile

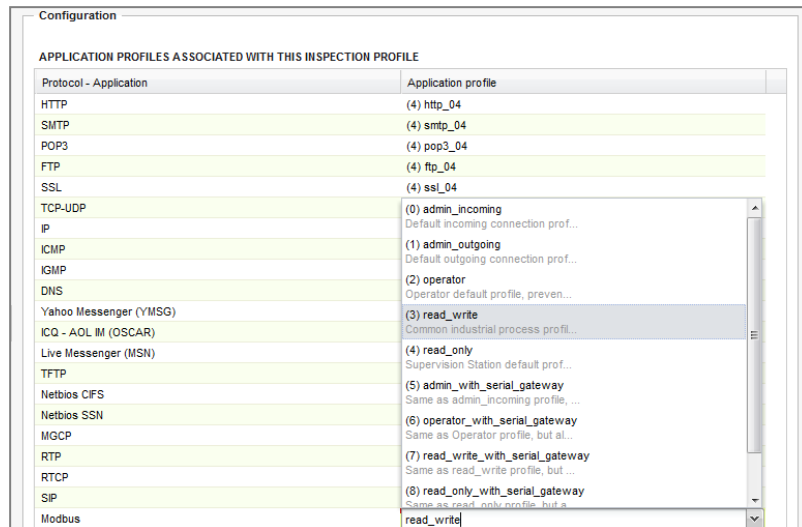
1. In the **Application protection > Protocols > Industrial protocols** menu, click on the industrial protocol to be configured (*Modbus* in the example). The menu for selecting protocol profiles offers 9 predefined profiles (numbered from 0 to 8) and a customized profile (9),
2. By clicking on each of these profiles, view the prohibited or allowed public operations and locate the profile corresponding to the configuration you wish to set up.
3. If none of the predefined profiles meet your needs, choose profile "[9]" which will be used during the analysis. Select the action *Scan* for each public operation to allow. Click on **Apply**.

Using this profile in the application inspection profile

1. In the **Configuration > Application protection > Inspection profiles** menu, click on **Go to profiles**.
2. For a more legible configuration, select the IPS profile bearing the same number as the selected protocol profile. For example, if you have chosen to apply the protocol profile titled "Read_write" (profil no. 3) for the industrial protocol being considered (*Modbus* in the example), select the IPS profile named "[3] IPS_03" which will apply this protocol profile by default.

**NOTE**

If this profile is unavailable, select an unused IPS profile, then double-click on the application profile applied by default for the industrial protocol and select the profile to use:



3. You can rename this profile in order to give it a more representative name (**Edit > Rename** menu). **Example:** "*IPS_Modbus_Protocol*".

Modifying the action of the "Function code denied" alarm

1. In the **Configuration > Application protection > Applications and protections** menu, select the customized inspection profile used in the filter rule (*IPS_Modbus_Protocol* in the example).
2. Enter the name of the industrial protocol to be filtered in the search field. All alarms relating to this protocol will appear.
3. Locate the "function code denied" alarm and modify its action by double-clicking on *Allow*. Select *Block*.
4. Click on **Apply**.

Modifying the filter rule dedicated to the industrial protocol

1. In the **Configuration > Security policy > Filter - NAT** menu, select the filter rule created to discover industrial traffic going through the network.
2. Double-click on the inspection profile (*Security inspection* column) and choose the profile selected for the industrial protocol analysis (*IPS_Modbus_Protocol* in the example).
3. Click on **Save and apply**.

The filter rule will then look like this:

FILTERING		NAT						
<div>Searched text</div> <div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></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