SecFlow-1v
Ruggedized Multiservice Gateway

- Enhanced security capabilities: stateful firewall, VPNs, automated PKI and optional SCADA-aware firewall
- Resilient HSPA+/LTE cellular network uplink for maximum service continuity and built-in GNSS for location reporting
- Reduced OPEX with secure Zero Touch provisioning
- Hosting of third-party software for customized applications (edge computing)
- SCADA protocol gateway for IEC-101, IEC-104, Modbus-RTU/TCP, and DNP3 protocols
- Option for second cellular modem, WiFi, or LoRaWAN
- Embedded, isolated DC power supply
- Enhanced EMI and immunity according to IEC 61850-3, IEEE 1613*, EN 50121-4
- Certified for use in AT&T wireless network

SecFlow-1v is a multiservice gateway optimized for industrial IoT and other mission-critical applications, a member of RAD’s SecFlow suite of ruggedized Ethernet products.

In addition to its communication capabilities, SecFlow-1v is an open platform suitable for quick introduction of new capabilities, by hosting third-party software, using Linux containers.

SecFlow-1v features four GbE Copper ports with PoE options and one GbE SFP port, two serial RS-232 ports or one RS-232 and one RS-485/2W port, and a cellular modem with two SIM cards for maximum link resiliency.

SecFlow-1v is equipped with serial interfaces for connectivity of legacy RTUs with new IP-based IED systems. SecFlow-1v gateway converts legacy IEC-101 protocol to IP-based IEC-104, Modbus-RTU to Modbus/TCP and encapsulated DNP3 serial to DNP over IP, enabling seamless communication from IP SCADA to both old and new RTUs. This provides a single box solution for multi-service applications and smooth migration to all-IP networks.

In addition to its cellular uplink that provides wireless connection towards the network, SecFlow-1v can be equipped with additional wireless technologies. When equipped with WiFi, SecFlow-1v acts as an access point, aggregating several users, such as on-site technicians or sensors, saving the need for wired connection or multiple costly cellular connections from each device.

When equipped with LoRaWAN radio, SecFlow-1v aggregates multiple low-power low-bandwidth sensors/meters deployed over a wide area. This provides an ideal solution for rural and other non-dense areas saving CAPEX and OPEX.

The gateway is designed for installation under harsh environmental conditions. It features DIN-rail mount, IP30 protection level, wide operating temperature range (-40°C to 75°C) without fans, and EMI immunity (IEC 61850-3, IEEE 1613 and EN 50121-4).

SecFlow-1v supports several powering options that all use an embedded isolated DC power supply, to meet the harsh environmental requirements.

MARKET SEGMENTS AND APPLICATIONS
SecFlow-1v addresses Industrial IoT, for example:
- Distributed automation in secondary substations
- Smart meter and sensors concentration
- Water resources management
- Industry 4.0
- Smart and safe cities
- Out-of-band management using cellular uplink
- Smart retail

INTEROPERABILITY
SecFlow-1v operates with RAD SecurityGateway, SecFlow-1, SecFlow-2, and with third party VPN aggregators.

ROUTER AND VPN SERVICES
SecFlow-1v features static routing, RIPv2, OSPF, BGP, VRF and NAT/NAT-Traversal.

The device features a VPN gateway with two operation modes:
- Inter-site connectivity using IPsec or Open VPN tunnels
- Remote user access, using SSH

* This feature will be released in a future version.
SecFlow-1v
Ruggedized Multiservice Gateway

Inter-site VPN-based encrypted link ensures L3 transparent connection of the Ethernet networks sites.
For remote access, the router uses an SSH-encrypted tunnel, with user authentication and specific access authorization.

LAYER-2 SWITCH
SecFlow-1v provides local switching capabilities with and without VLAN support, maintaining 2K MAC addresses and 16 broadcast domains (VLAN IDs).
QoS:
• Ingress policer, egress shaper
• Classification based on: Port, 802.1p, IPv4 DCSP
• Scheduling
  • Four priority queues
  • Strict and Weighted Round Robin (WRR)

MANAGEMENT AND SECURITY
The device can be managed via the SecFlow web-based interface (HTTP/HTTPS).
For easy and safe deployment, RAD offers Zero Touch provisioning thus reducing OPEX and providing a simple way to securely deploy thousands of elements in the network.
SecFlow-1v also supports a variety of access protocols, including CLI and TFTP/SFTP.

SCADA-Aware Firewall*
SecFlow-1v supports SCADA-aware firewall, providing network-based distributed security, especially designed for critical infrastructure SCADA applications (IEC-104, DNP3-TCP, and Modbus-TCP). The device monitors SCADA commands, using deep packet inspection, to validate whether they fit the intended application purpose.

Remote Terminal Unit/Programmable Logic Controller
Ordering options with Programmable Logic Controller (PLC) present an all-in-one-box solution from a single source for distribution automation, industrial automation, building automation, etc., supporting Modbus, DNP3, IEC-104 and BACnet SCADA masters. The devices can be programmed using:
• Ladder logic in accordance with EC 61131-3
• Instruction List (IL)
• Functional Block Diagram (FBD)
• Sequential Function Chart (SFC)
• Structured Text (ST)
SecFlow-1v devices with PLC module offer comprehensive cyber security relying on stateful firewall or SCADA firewall (optional), VPNs such as IPsec and OpenVPN, automated PKI, as well as RADview management with SIEM. Zero Touch provisioning allows secure service activation and maintenance, with low OPEX.

* This feature will be released in a future version.

Figure 1. Industrial IoT Backhaul
Specifications

CAPACITY

| Memory          | 1 GB RAM (unless otherwise specified) |

ETHERNET INTERFACES

| Fiber          | 1 x 1000FX, SFP socket |
| Copper         | 4 x 10/100/1000BASE-T |
| PoE (optional) | 2 x 30W, 4 x 15W, 1 x 60W* |
| Max Frame Size | 1.5 kB |

SERIAL INTERFACES

| Isolation      | Non-isolated/Isolated (for specific ordering options) |
| Serial Interface | 2 x RS-232 ports |
|                | 1 x RS-232 + 1 x RS-485 ports |

BRIDGE

| Compliance     | IEEE 802.1Q |
| Max. Number of Concurrent VLANs (Broadcast domains) | 16 |
| MAC Address Table | 2K |
| Operation Mode | VLAN-aware learning bridge |

MODEMS

| Dual SIM Cellular Modem | LTE bands |
|                        | HSPA+/EVDO networks (technology backward compatible) |

FOTA

Firmware upgrade Over the Air

Configurable Cellular Authentication

PAP, CHAP

Certification

Verizon Wireless*

PTCRB certification

SIM Card

Mini SIM, 25 mm x 15 mm (0.98 in x 0.59 in)

Form factor: 2FF

WiFi Module

IEEE 802.11ac/a/b/g/n

Dual band 2.4GHz or 5GHz (software selectable)

Up to 8 users

LoRaWAN Modem

433MHz/868MHz/915MHz/923MHz bands

SX1301 base band processor emulating 49 x LoRa demodulators, 10 parallel demodulation paths

8 uplinks channel and 1 downlink channel

2 x SX125x Tx/Rx front-ends high/low

Table 1. Modem Frequency Bands

<table>
<thead>
<tr>
<th>LTE Ordering Code</th>
<th>Modem Category and Frequency Bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>CAT 4 EMEA/Korea/Thailand</td>
</tr>
<tr>
<td></td>
<td>LTE FDD: B1/B3/B5/B7/B8/B20</td>
</tr>
<tr>
<td></td>
<td>LTE TDD: B38/B40/B41</td>
</tr>
<tr>
<td></td>
<td>WCDMA: B1/B5/B8</td>
</tr>
<tr>
<td></td>
<td>GSM: B3/B8</td>
</tr>
<tr>
<td>L2</td>
<td>CAT 4 North America (AT&amp;T)</td>
</tr>
<tr>
<td></td>
<td>LTE FDD: B2/B4/B12</td>
</tr>
<tr>
<td></td>
<td>WCDMA: B2/B4/B5</td>
</tr>
<tr>
<td>L3</td>
<td>CAT 4 Australia/New Zealand/Taiwan/Brazil</td>
</tr>
<tr>
<td></td>
<td>LTE TDD: B40</td>
</tr>
<tr>
<td></td>
<td>WCDMA: B1/B2/B5/B8</td>
</tr>
<tr>
<td></td>
<td>GSM: B2/B3/B5</td>
</tr>
<tr>
<td>L4</td>
<td>CAT 4 North America, Verizon wireless + AT&amp;T LTE</td>
</tr>
<tr>
<td></td>
<td>LTE FDD: B2/B4/B5/B12/B13/B14/B66/B71</td>
</tr>
<tr>
<td></td>
<td>WCDMA: B2/B4/B5</td>
</tr>
</tbody>
</table>

NETWORKING

VPN

L3 mGRE DMVPN

L3 IPsec VPN

OpenVPN client

Gateway

SCADA gateway for IEC101/104, Modbus RTU/TCP and DNP3

QUALITY OF SERVICE (QOS)

Policing

Per port ingress policer, L1 rate, CIR

Egress Queues

4 queues per port

Queue Mapping

Per ingress port; p-bit mapping, dscp mapping

Scheduling

Strict Priority / WRR

Shaping

Per port egress shaper, L1 rate, CIR

ROUTER

Protocols

RIPv2, OSPFv2, BGP, VRF, IPv4, IPv6, NAT, NAT-T

Static routing

Tx power up to 25 dBm, Rx sensitivity down to -139 dBm @ SF12, BW 125 kHz

UDP packet forwarder

LoRaWAN Server

As per specification v1.0.4 (optional)

*This feature will be released in a future version.
**SecFlow-1v**  
Ruggedized Multiservice Gateway

### RTU/PLC

**Inputs**  
- 6 x digital inputs, max DC input voltage 24 VDC  
- 6 x analog inputs as ordering options:  
  - 0-5 VDC  
  - 0-12 VDC  
  - 0-24 VDC  

**Outputs**  
- 6 x digital outputs:  
  - relay-based ordering option: 3 pins;  
    NO/COM/NC, 250 VAC/8 A max, 400 VDC/8 A max  
  - solid state relay-based ordering option for Class I/Div 2 certified (Hazloc) devices: 2 pins;  
    NO/COM, 100 VAC/100 mA max, 140 VDC/100 mA max

### Web GUI

**Northbound to SCADA Masters**  
- Modbus, DNP3, IEC-104, BACnet

**Masters**  
- Up to 5 concurrent masters  
  - Modbus TCP  
  - DNP3 TCP or BACnet TCP  
  - IEC-104

**Additional I/O Points**  
- Up to 400  
  - Split between 2 Modbus-RTU

**Slaves**  
- Up to 10 Modbus-TCP slaves

### MANAGEMENT

**Control Port**  
- RS-232 interface, RJ45 connector

**DHCP**  
- DHCP client  
- DHCP server for WiFi clients

**Protocols**  
- TFTP/SFTP  
- Web-based interface using HTTPS or HTTP

**Options**  
- CLI with password-protected access  
- SMS commands  
- USB 2.0 host for software upload*  
- SD memory card*

### TIMING

**Timing**  
- Local time setting  
- SNTP

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*This feature will be released in a future version.

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**Figure 2. Automation Gateway with PLC/RTU**
SECURITY

**Firewall**
- Stateful firewall
- SCADA-aware firewall

**Login**
- Login lockout

**ACL**
- ACL with MAC white list

**TACACS+**
- Multiuser TACACS+

**IPsec**
- AES128 and AES256 GCM encryption
- PKI with X.509 certification
- IKEv1, IKEv2, SHA2
- Interoperability with SCEP server 2012 and higher

RESILIENCY

**Routing**
- Dynamic routing, OSPFv2, BGP

**Cellular ISP Redundancy**
- SIM cards backup or dual modem support

**IPsec VPN Redundancy**
- Policy-based
- Route-based

MONITORING

**GNSS**
- GPS – American (default)
- Galileo – European

DIAGNOSTICS

**Interface Counters**
- Per port

**Syslog**

**SNMPv3**
- GET and traps

**LEDs**
- Including alarm indication

**Dry Contacts**
- 2-in and 2-out

**SMS**
- Status indication

GENERAL

**Compliance**
- Enhanced EMI and immunity according to
  - EN 50121-4
  - IEC 61850-3
  - IEEE 1613*

Environment

<table>
<thead>
<tr>
<th>Storage Temperature</th>
<th>Operating Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 to 85°C (-40 to 185°F)</td>
<td>Enclosure 1: -40 to 65°C (-40 to 149°F)</td>
</tr>
<tr>
<td></td>
<td>Enclosure 2: -40 to 75°C (-40 to 167°F) w/o PoE</td>
</tr>
<tr>
<td></td>
<td>Enclosure 3: -40 to 60°C (-40 to 140°F) with PoE</td>
</tr>
<tr>
<td>Humidity</td>
<td>Up to 90%</td>
</tr>
</tbody>
</table>

*Note: The actual chassis and operating temperature depend on the ordering options.*

Physical

**Table 2. Dimensions and Weight**

<table>
<thead>
<tr>
<th>Enclosure 1 (E1)</th>
<th>Enclosure 2 (E2)</th>
<th>Enclosure 3 (E3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (mm)</td>
<td>138 (5.43)</td>
<td>157.2 (6.19)</td>
</tr>
<tr>
<td>Width (cm)</td>
<td>53.3 (2.1)</td>
<td>82.8 (3.25)</td>
</tr>
<tr>
<td>Depth (cm)</td>
<td>123.3 (4.85)</td>
<td>150 (5.9)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>0.88 kg (1.94 lb)</td>
<td>1.4 kg (3.1 lb)</td>
</tr>
</tbody>
</table>

**Power**

**Power Supply**
- Embedded isolated power supply
  - 12V: 11–30 VDC
  - 48V: 44–57 VDC (Dual power inlet)
  - WDC: 20–60 VDC (Dual power inlet)

**Power Consumption**
- Enclosure 1: < 10 W
- Enclosure 2: < 17 W (regular operation / no PoE)
- < 77 W (60W for PoE)
- Enclosure 3: < 17 W

*This feature will be released in a future version.*
SecFlow-1v
Ruggedized Multiservice Gateway

Ordering

Legend
SF-1V/Ex/@/R/#/$/%/Lx/*/*/Lx/@/LRx/PLC

Ex  Chassis
E1  E1 enclosure
E2  E2 enclosure
E3  E3 enclosure

@  Power Supply
12V  12 VDC (11–30 VDC)
48V  48 VDC (44–57 VDC)
WDC  Wide-range 20–60 VDC

R  Random-access memory (RAM)
2R  2GB

#  Ethernet Ports
4U1S  1 x 1000FX, 4 x 10/100/1000BASE-T ports

$  Power over Ethernet (PoE)
POE  PoE on 4 x 10/100/1000BASE-T
2PA  PoE on 2 x 10/100/1000BASE-T for RAD’s Airmux and standard PoE for the remaining 2 x 10/100/1000BASE-T ports

%  Serial Ports
2RS  2 x RS-232 ports
2RSM  1 x RS-232 port, 1 x RS-485 port

Lx  Cellular Ports
HSP  HSPA+ (high-speed packet access) modem, 3.5 Gb
L1  LTE modem for Europe
L2  LTE modem for North America AT&T
L3  LTE modem for Oceania and Latin America
L4  LTE modem for North America, Verizon wireless + AT&T

Notes:
- L1(2,3,4) means that any of L1/L2/L3/L4 options can be ordered.
- In options with dual modems, both modems are of the same type (HSP, L1, L2, L3, or L4).
- The cellular modem is supplied with two matching antennas (see Supplied Accessories).

*  GNSS
G  Integrated GPS

Note: The GPS modem is supplied with one antenna (see Supplied Accessories).

&  WiFi Interface
WF  Wireless LAN

Note: The WiFi modem is supplied with two matching antennas (see Supplied Accessories).

^  Ruggedized Options
RG  extended temperature, IEC 61850-3 and IEEE-1613 compliant
RL  EN 50121-4 certified
GO  extended temperature, Class I/DIV 2 certified

LRx  LoRaWAN Modem
LR1  LoRaWAN modem with 8 channels and frequency scheme according to EU433
LR2  LoRaWAN modem with 8 channels and frequency scheme according to EU868
LR3  LoRaWAN modem with 8 channels and frequency scheme according to AU915
LR4  LoRaWAN modem with 8 channels and frequency scheme according to US915
LR6  LoRaWAN modem with 8 channels and frequency scheme according to AS923

Note: The LoRaWAN modem is supplied with one matching antenna.

PLC  Programmable Logic Controller
PLC  6 digital inputs, 6 digital outputs, 6 analog inputs, 5 VDC
PLC12  6 digital inputs, 6 digital outputs, 6 analog inputs, 12 VDC
PLC24  6 digital inputs, 6 digital outputs, 6 analog inputs, 24 VDC
PLCGO  Class I/DIV 2 certified (Hazloc) - 6 digital inputs, 6 digital outputs, 6 analog inputs 5 VDC, solid-state relay-based
PLCGO12  Class I/DIV 2 certified (Hazloc) - 6 digital inputs, 6 digital outputs, 6 analog inputs 12 VDC, solid-state relay-based
PLCGO24  Class I/DIV 2 certified (Hazloc) - 6 digital inputs, 6 digital outputs, 6 analog inputs 24 VDC, solid-state relay-based

Note: PLC software is included upon ordering the /PLC ordering option.

I  uCESP Container
CSP  RS232 control signals (DTR and DCD) on S1 port managed by the uCESP container

* This feature will be released in a future version.
**SecFlow-1v**

**Ruggedized Multiservice Gateway**

**RECOMMENDED CONFIGURATIONS**

- SF-1V/E1/12V/4U1S/2RS/HSP
- SF-1V/E1/12V/4U1S/2RS/HSP/G
- SF-1V/E1/12V/4U1S/2RS/L1(2,3,4)
- SF-1V/E1/12V/4U1S/2RSM/HSP
- SF-1V/E1/12V/4U1S/2RSM/L1(2,3,4)
- SF-1V/E1/WDC/4U1S
- SF-1V/E1/WDC/4U1S/2RS/RL
- SF-1V/E1/WDC/4U1S/2RS/HSP
- SF-1V/E1/WDC/4U1S/2RS/L1(2,3,4)
- SF-1V/E2/12V/4U1S/2RS/HSP/G/WF
- SF-1V/E2/12V/4U1S/2RS/HSP/G/HSP
- SF-1V/E2/12V/4U1S/2RS/L1(2,3,4)/L1(2,3,4)
- SF-1V/E2/12V/4U1S/2RS/L1(2,3,4)/G/L1(2,3,4)
- SF-1V/E2/12V/4U1S/2RS/L4/G/LR1
- SF-1V/E2/12V/4U1S/2RS/L4/G/LR2
- SF-1V/E2/12V/4U1S/2RS/L3/G/LR3
- SF-1V/E2/12V/4U1S/2RS/L4/G/LR4
- SF-1V/E2/12V/4U1S/2RS/PLC
- SF-1V/E2/48V/4U1S/2PA/2RS
- SF-1V/E2/48V/4U1S/2PA/2RS/L1(2,3,4)
- SF-1V/E2/48V/4U1S/2PA/2RS/L1(2,3,4)/WF
- SF-1V/E2/48V/4U1S/2PA/2RS/L1(2,3,4)/G/L1(2,3,4)
- SF-1V/E2/48V/4U1S/2PA/2RS/L1(2,3,4)/L1(2,3,4)
- SF-1V/E2/48V/4U1S/2PA/2RS/L1(2,3,4)/WF
- SF-1V/E2/48V/4U1S/2PA/2RS/L1(2,3,4)/G/L1(2,3,4)
- SF-1V/E2/48V/4U1S/2PA/2RS/L1(2,3,4)/L1(2,3,4)
- SF-1V/E2/WDC/4U1S
- SF-1V/E2/WDC/4U1S/L1/L1
- SF-1V/E2/WDC/4U1S/2PA/2RS/HSP
- SF-1V/E2/WDC/4U1S/2PA/2RS/L1(2,3,4)
- SF-1V/E2/WDC/4U1S/2PA/2RS/L1(2,3,4)/WF
- SF-1V/E2/WDC/4U1S/2PA/2RS/HSP/WF
- SF-1V/E2/WDC/4U1S/2PA/2RS/HSP/G/HSP
- SF-1V/E2/WDC/4U1S/2RS/L1(2,3,4)/G/L1(2,3,4)

Please contact RAD Sales for more details on future products.

**SPECIAL CONFIGURATIONS**

- **Zero Touch Provisioning**
  - **PS-ZT-PRE_CONFIGURATION**
    - One Zero Touch pre-configuration service package per each SecFlow-1v unit
    - and either of the following:
  - **PS-ZT-STAGING**
    - Local Zero Touch staging service package (one per project)
  - **PS-ZT-ONSITE-STAGING**
    - Onsite Zero Touch staging service package (one per project)

Please contact your local RAD partner for additional configuration options.

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* This ordering option is part of RAD’s roadmap. Regarding availability, follow updates of official rollout and release announcements.
SUPPLIED ACCESSORIES

SF-ANT-GPS-PAS-3DBI-MAG/3M
GPS passive antenna, 3m, for options with integrated GPS

SF-ANT-HSP-2DBI-SMA
HSP antenna, 2 dBi, for options with HSPA+ (high-speed packet access) modem

SF-ANT-LTE699-4DBI-SMA
LTE antenna, 4dBi, for options with LTEx modems

SF-ANT-WIFI-DUALBAND-3DBI-SMA
WiFi dual band antenna, 3 dBi, for options with WiFi modem

OPTIONAL ACCESSORIES

CBL-RJ45/D9/F/6FT
Serial console and RS-232 data ports cable

CBL-RJ45/D9/F/DM
RJ45 to DB9 female shielded cable for /CSP option, 2m

CBL-SF-RJ45-RS485
RS485 open-ended shielded cable RJ45-DB

RM-DIN-SINGLE
Rack Mount adaptor for single DIN RAIL device

RM-DIN-19
19” Rack Mount adaptor for DIN RAIL device

USB holder kit
For SF-1V/E2/12V/4U1S/2RS/L4/G/GO ordering option

Power Supplies

SF-AC-48VDC-40W (to be used with non-POE options)
External DIN rail AC to 48 VDC power supply, 40 W, -20 to 60°C (-4 to 140°F); 20 W at 60°C (140°F) and above

SF-AC-48VDC-120W
External DIN rail AC to 48 VDC power supply, 120 W, -20 to 60°C (-4 to 140°F); 60 W at 65°C (149°F) and above

SF-24VDC-48VDC-240W
24 VDC to 48 VDC power supply, 240 W, -40 to 50°C (-40 to 122°F); 120 W at 65°C (149°F) and above

SF-AC-12VDC-40W
AC to 12 VDC power supply, 40 W, -20 to 60°C (-4 to 140°F); 20 W at 65°C (149°F) and above

Antennas

SF-ANT3G-2M
Outdoor antenna for SecFlow 3G cellular modem, 2m connecting cable, 2.2 dBi, 824-894 MHz/900 MHz/1800 MHz/1900 MHz

SF-ANT3G-5M
Outdoor antenna for SecFlow 3G cellular modem, 5m connecting cable, 2.2 dBi, 824-894 MHz/900 MHz/1800 MHz / 1900 MHz

SF-ANT4G-2M
Outdoor antenna for SecFlow 4G cellular modem, 2m connecting cable, 3 dBi, 699-960 MHz/1710-2170 MHz/2500-2690 MHz

SF-ANT4G-5M
Outdoor antenna for SecFlow 4G cellular modem, 5m connecting cable, 3 dBi, 699-960 MHz/1710-2170 MHz/2500-2690 MHz

SF-ANT-LTE700-7DBI-MGNT
Outdoor magnetic base antenna for SecFlow-1v LTE options and for LoRaWAN 868 MHz, 7 dBi

Software

SF-1V-SW/SCDFW/IDS*
Software package for SecFlow-1v, SCADA firewall for IEC-104, DNP3-TCP, MODBUS-TCP, Tap mode for IDS

SF-1V-SW/SCDFW/IDSIPS*
Software package for SecFlow-1v, SCADA firewall for IEC-104, DNP3-TCP, MODBUS-TCP, Inline for IDS and/or IPS

* This ordering option is part of RAD’s roadmap. Regarding availability, follow updates of official rollout and release announcements.

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