Micro-DPU Series
Single-Channel, Compact Distribution Point Unit

Feature Highlights:

- Data rates up to 2 Gbps, leveraging the latest 200 MHz G.hn band-plans standardized in ITU-T G.9960 Amendments 1 and 2
- Uplink and downlink interfaces implemented as INF-8074 compliant small form-factor (SFP) modules for complete modularity
- Downlink wireline options for G.hn over twisted-pair or coax and 1G/2.5G Ethernet over Cat-5e
- Operating temperature range -40°C to +65°C, 10W maximum power
- Flexible power options including both Reverse Power Feed compliant to RPF ETSI TS 101 548 over twisted pair or coax or local 12V DC power
- ITU-T K.21 over-voltage protection
- Automatic detection of neighbor µDPUs, with synchronization of TDD time slots to eliminate near-end cross-talk (NEXT)
- Compatible with MaxLinear cloud-based VectorBoost platform to eliminate far-end cross-talk (FEXT)
- Flexible bandwidth provisioning, supporting both fixed TDD ratios or dynamic time allocation (DTA) on both coax and twisted-pair
- Directly supported in mainline OpenWrt

Product Summary

The Methode micro-DPU (or µDPU) is a versatile, compact, single-channel distribution point unit (DPU) that can be deployed in a variety of FTTx situations for ultra-fast broadband service delivery. It is an SDN-ready solution with no dependency on proprietary vendor SDKs instead running a mainline distribution of OpenWRT that can be adapted and optimized for specific operator needs.
Micro-DPU Functional Block diagram

The micro-DPU consists of a power supply system and a powerful dual core ARM cortex A53 embedded processor optimized for networking applications. The micro-DPU can be powered using a local 12V to 18V supply or reverse power fed from the customer premises using a compatible ETSI TS 101 548 power injector.

Figure 1 micro-DPU block diagram
micro-DPU Overview

The micro-DPU was originally conceived as a reverse power fed, network managed, GPON fiber link extender. The uplink SFP cage accepts a GPON ONT SFP module with a standard SGMII interface. However, depending on the case use scenario, the uplink can accept any optical or copper SFP module rated up to a link 2.5Gbps with a standard SGMII or 1000BASE-X electrical interface on the SFP 20-pin connector. The downlink SFP cage can be populated with one of several supported G.hn SFP modules, including variants for single-pair SISO, 2-pair MIMO and F-type for coax, or it can be populated with a 1000BASE-T or 2500BASE-T SFP module for downlinks cabled with CAT-5e. For SISO and MIMO phone line connections the micro-DPU can be reverse powered from the customer premises. For Ethernet over CAT 5e or coax case uses, the micro-DPU can be locally powered using a DC-supply between 12V and 18V. When reverse powered, a small patch cable is needed to jump data between the downlink wireline SFP module and the power splitter built into the micro-DPU. This is why the micro-DPU front bezel includes a dual-RJ connector interface. Viewed from the front, the right-hand most RJ connector is for RPF DC-power and data combined while the left-hand RJ connector is for data only. If the micro-DPU is locally powered, the copper media cable must be connected directly to the input of the downlink SFP modules.

Mechanical Dimensions

![Figure 2: Mechanical Dimensions](image-url)
Product Features and Specifications

General Specifications

Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature</td>
<td>-40°C</td>
<td></td>
<td>85°C</td>
<td>Ambient</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C</td>
<td></td>
<td>65°C</td>
<td>Ambient</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td></td>
<td></td>
<td>95%</td>
<td>Relative</td>
</tr>
</tbody>
</table>

Power supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPF</td>
<td>57V DC</td>
<td></td>
<td></td>
<td>250m max loop length</td>
</tr>
<tr>
<td>Local Power</td>
<td>12V DC</td>
<td>1,2</td>
<td>18V DC</td>
<td>1,2 20W rating recommended</td>
</tr>
<tr>
<td>Micro-DPU power dissipation</td>
<td></td>
<td>10W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1 ±10%
2 barrel plug, 2.5mm ID, center positive polarity

SFP Module Interfaces

- Supports SFP modules compliant to INF-074i
- 1000BASE-x, SGMII electrical interface (on 20-pin electrical interface)
- Line rate up to 2.5Gbps

USB Port

- Type-C connector interface running USB 2.0

Management, control and protocols

- IPv4/Ipv6 dual stack concurrent
- DHCP/TFTP
LED Indication

<table>
<thead>
<tr>
<th>LED#/LED color</th>
<th>Off</th>
<th>Green</th>
<th>Green-Flashing</th>
<th>Red</th>
<th>Red-Flashing</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED #1</td>
<td>micro-DPU has no power input</td>
<td>micro-DPU powered via RFP or local DC</td>
<td>micro-DPU software update started</td>
<td>micro-DPU software update failed</td>
<td>n/a</td>
</tr>
<tr>
<td>LED #2</td>
<td>micro-DPU has no power input</td>
<td>micro-DPU has an IP/IPv6 address and Wireguard VPN connection</td>
<td>micro-DPU has an IP/IPv6 address, but no Wireguard VPN connection</td>
<td>micro-DPU has no IP/IPv6 address</td>
<td>micro-DPU is trying to get an IP/IPv6 address.</td>
</tr>
<tr>
<td>LED #3</td>
<td>micro-DPU has no power input</td>
<td>micro-DPU has no active alarms</td>
<td>micro-DPU high CPU or MEM threshold</td>
<td>micro-DPU over-temperature alarm</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Software: OS and File System

- OS/Kernel OpenWrt embedded Linux with mainline Linux kernel
- F2FS RootFile system

Software: Tools, Utilities and Features

- `sysupgrade` – used to remotely replace the entire current OpenWrt installation with a new version.
- WireGuard® - a convenient to use, encryption secure VPN: [https://www.wireguard.com/](https://www.wireguard.com/)
- Open vSwitch – a multilayer virtual switch: [https://www.openvswitch.org/](https://www.openvswitch.org/). The micro-DPU incorporates the main user space components required for Open vSwitch to function however the main OVS tools (ovs-vsctl, ovs-ofctl, etc) are packaged separately to conserve some room in memory and to allow more configurability.
- Zabbix - Zabbix agent for network monitoring: [https://www.zabbix.com/](https://www.zabbix.com/)
- Chrony – an implementation of the Network time Protocol (NTP) for synchronizing the system clock with that of an NTP server: [https://chrony.tuxfamily.org/](https://chrony.tuxfamily.org/)
- **linuxptp** - The PTP daemon implements version 2 of the Precision Time Protocol (PTP) as defined by the IEEE 1588-2008 standard for hardware and software time stamping: [http://linuxptp.sourceforge.net/](http://linuxptp.sourceforge.net/)

- **gpsd** - a service daemon that acts as a translator between GPS and AIS receivers and their clients: [http://catb.org/gpsd/](http://catb.org/gpsd/)

- **brctl** – bridge control command used to create and manage Ethernet Bridges. Supports addbr/delbr and addif/delif: [https://linux.die.net/man/8/brctl](https://linux.die.net/man/8/brctl)

- **DHCP** – (udhcpc) is a Dynamic Host Configuration Protocol client geared primarily toward embedded systems, while striving to be fully functional and RFC compliant. The udhcpc client negotiates a lease with the DHCP server and runs a script when a lease is obtained or lost.

- **iperf3** - for measuring and tuning TCP and UDP bandwidth performance.

- **tcpdump** – a command line packet analyzer: [https://www.tcpdump.org/](https://www.tcpdump.org/)

- **GPIOs** – to configure and control peripherals such as the SFP ports and status indication LEDs.

- **i2c-tools** – a set of I2C tools for Linux. These tools were originally part of the lm-sensors package.

- **ifstat** - a tool used to report network interfaces bandwidth.

Other packages required by the customer can be installed but must be compatible and available with openWrt kernel.
Certification Compliance

UL listed and evaluated per UL/IEC 60950 and UL/IEC 62368.

- FCC Part 15 Subpart B
- IECS 003
- Radiated Emission per CISPR 32 (EN55032)
- EU: Conducted Emissions per CISPR 32 (EN55032)
- EU: Radiated Immunity per CISPR 35 (EN55035)
- EU: ESD per CISPR 35 (EN55035)
- EU: Magnetic Immunity per CISPR 35 (EN55035)
- Recommendation ITU-T K.21 enhanced test levels
- RoHS 6 of 6

Product applicable standards

- ITU-T Recommendation G.984 family for GPON
- ITU-T G.9966 Unified high-speed wireline-based home networking transceivers – Power spectral density specification
- ITU-T G.9961 Unified high-speed wireline-based home networking transceivers – Data link layer specification
- ITU-T G.9960 Unified high-speed wireline-based home networking transceivers – System architecture and physical layer specification
- ETSI TS 101 548 for reverse power feed
- INF-8074i Specification for SFP (Small Form-factor Pluggable) Transceiver
Speed and Reach

Throughput vs Distance (TNO test bench)

ISO 9001 Certified
Case Use Scenarios

MDU FTTx
Point-to-Point over Phone Line with RPF
MDU FTTx Point-to-Multipoint Over Coax