Active Taps
"Man in the Middle"

Presented By:

Don Hatfield, Director of Global Sales

Intrepid Control Systems, Inc.

Email : dhatfield@intrepidcs.com

Cell: (586) 260-7071

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31601 Research Park Dr., Madison Heights, MI 48071 USA 1-800-859-6265
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Do You Need an Active Tap?

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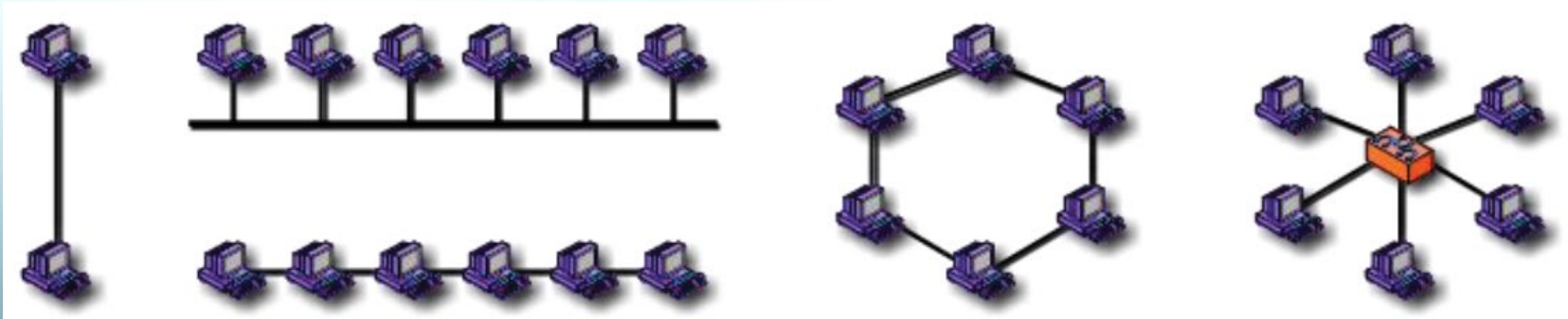31601 Research Park Dr., Madison Heights, MI 48071 USA 1-800-859-6265
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Networking Topologies

- Point-to-point (or Port, like a "private network")

- Bus (chained or attached) (like CAN, LIN)

- Star

- Ring (very uncommon)

- Complex topologies combine these

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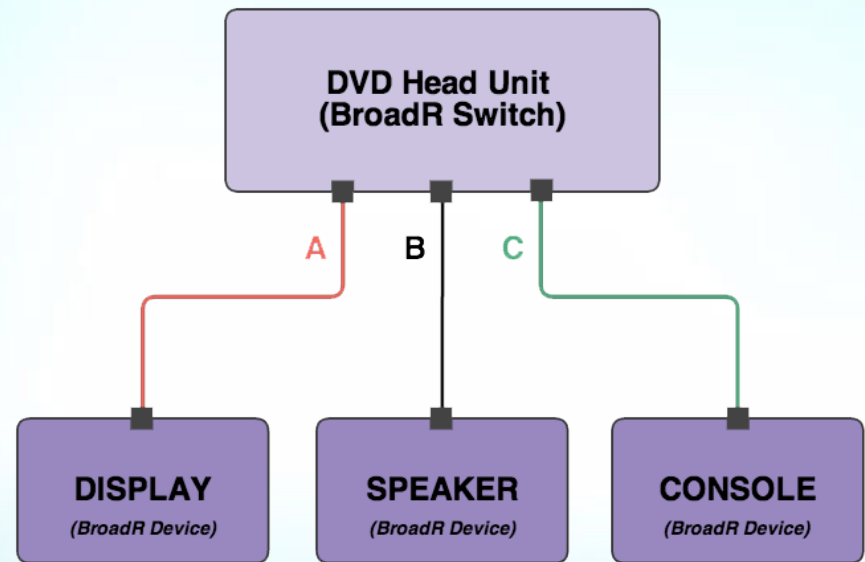31601 Research Park Dr., Madison Heights, MI 48071 USA 1-800-859-6265
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Switched Network Architecture

- Each ECU has its own private connection to the switch (no arbitration or collision)

- Switches route data to its proper destination

- No single leg would carry all the traffic

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Wait – Where's the OBD Port??

- The topology and switched architecture means there is **no single point to get all the network data**

- The PHY is sensitive so you **cannot connect/probe it** like CAN

- Ethernet requires new tactics and new network tools for

  - Monitoring

  - Logging

  - Simulation

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How to Monitor and Simulate for AE Networks

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Monitoring / Logging AE Data

- Option 1: Use a special "debug" port on switch
  - Configure switch to send copy of all traffic on all ports to a special port
  - Plug it into your PC (if port is compatible)

- Drawbacks:
  - Added cost (if left in production)
  - Potential vulnerability
  - Bad frames not forwarded
  - Exact timing is not provided (when did it hit the wire?)
  - Adds complexity (time/resources/testing/money)
  - Bottleneck (can one port handle traffic from all the others?)

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Monitoring / Logging AE Data

- The Best Option: Use an Active Tap
  - Inserted between an ECU and its switch (or between ECUs)
  - Port Forwarding (like a gateway, with a minimal delay)
  - Port Copying (sends copies of each frame to separate Ethernet port)
  - Time/Frame Encapsulation (Includes timestamp and original frame)

- Benefits
  - Minimize cost (only insert when needed, no debug port needed)
  - Minimize vulnerability (no debug port to tempt hackers)
  - Capture even bad frames (otherwise dropped by switch / NIC)
  - Minimize complexity (debug port costs time/money/resources)
  - Minimize bottleneck

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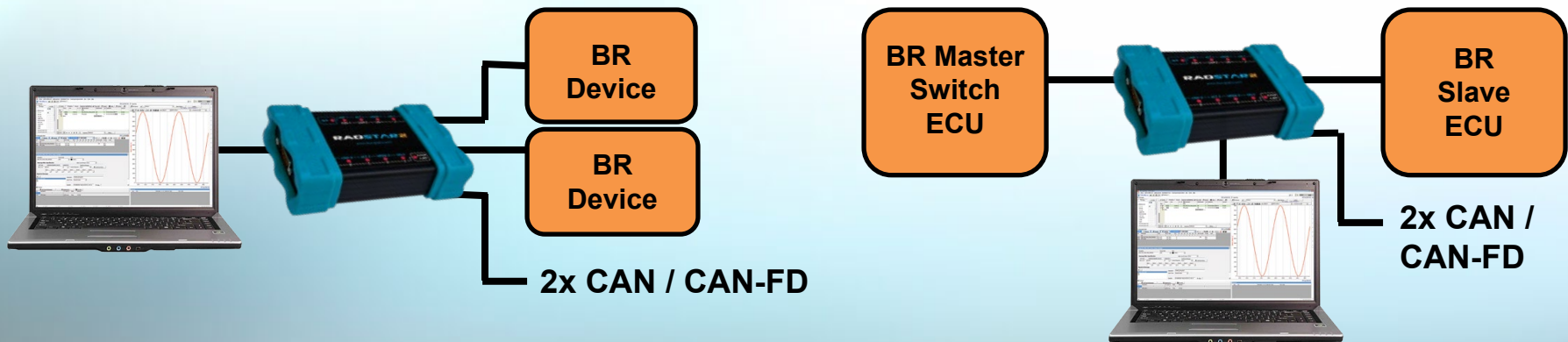automotive engineering
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RAD-Star 2

Active-Tap for Automotive Ethernet

- Tap copies full duplex communications with sub microsecond latency
- 2x CAN / CAN-FD
- 2x BR/100BASE-T1 PHYs
- 4.5 to 36V operation

Simulate errors by introducing errors between master and slave

BR Device

BR Device

2x CAN / CAN-FD

BR Master Switch ECU

BR Slave ECU

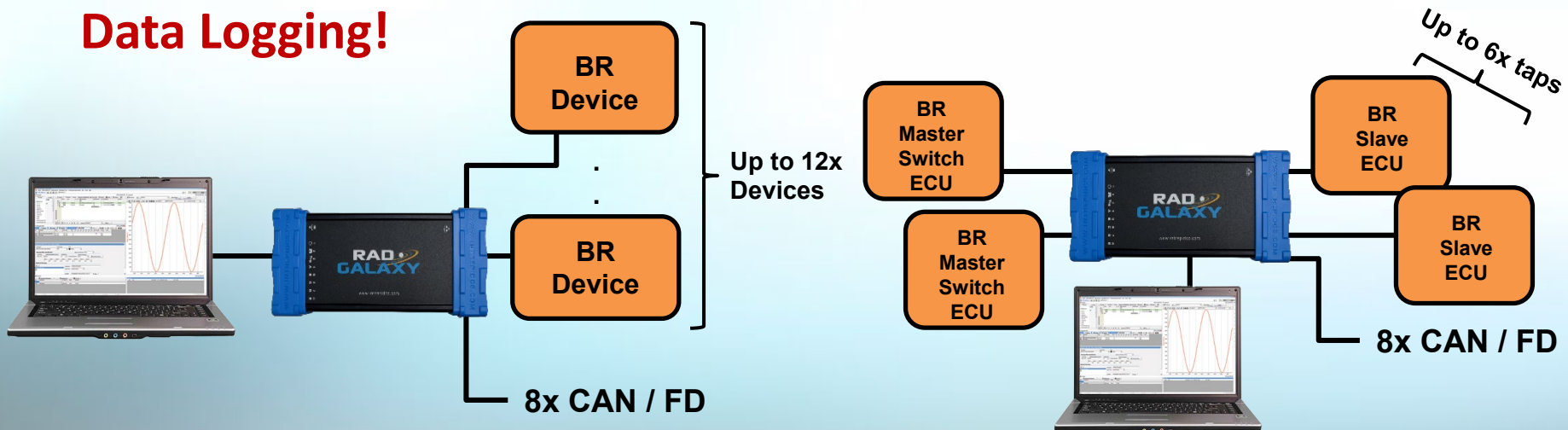**2x CAN / CAN-FD**

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RAD-Galaxy: Multi Active-Tap

- 6x Tap copies full duplex communications with sub-µsec latency
- 8x CAN / CAN FD
- 1x DoIP
- 12x BR /100BASE-T1 PHYs
- 4.5 to 36V operation

Includes Standalone Data Logging!
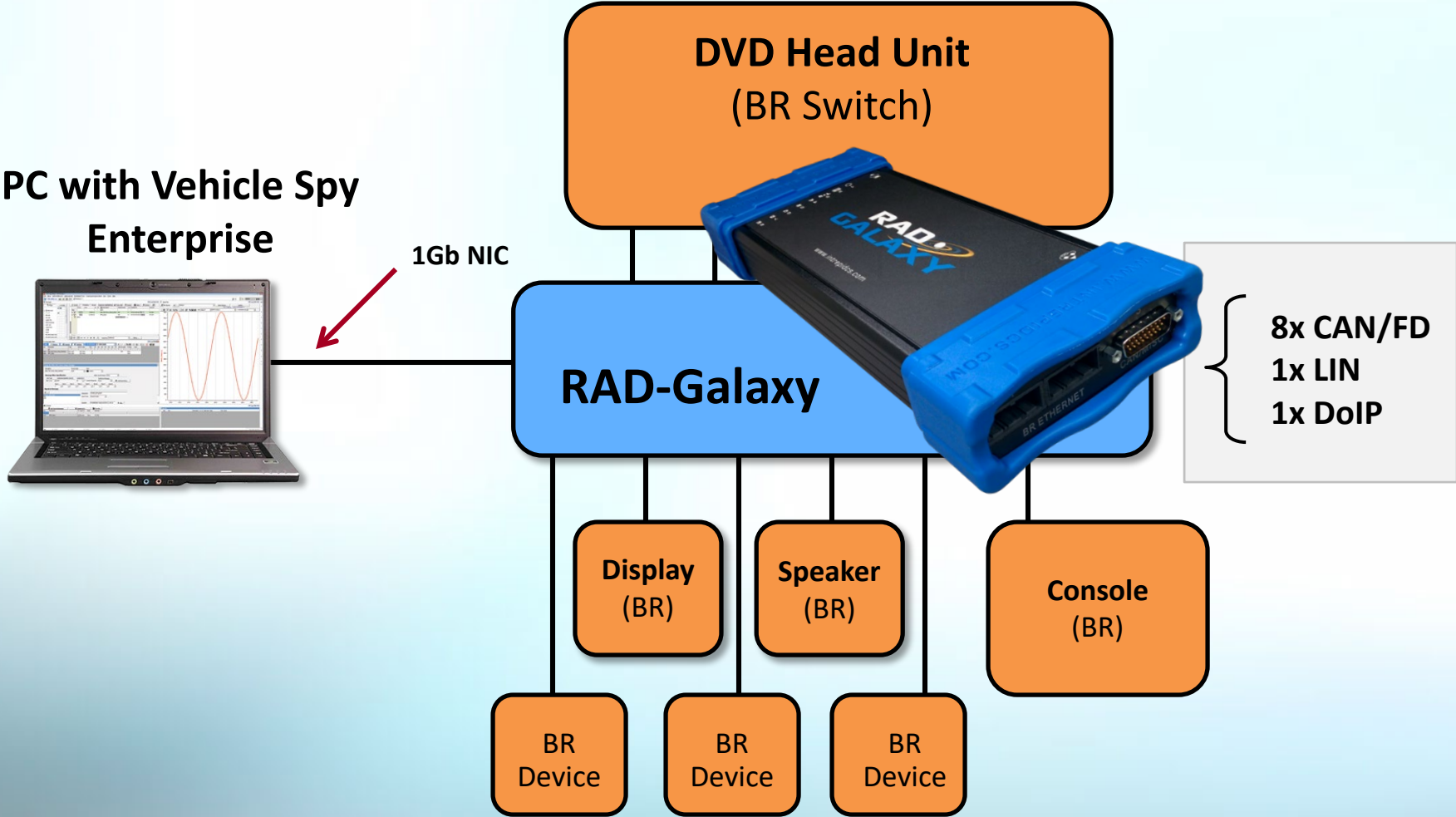
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RAD-Galaxy: Complete Solution

PC with Vehicle Spy Enterprise

1Gb NIC

DVD Head Unit
(BR Switch)

RAD-Galaxy

8x CAN/FD
1x LIN
1x DoIP

Display
(BR)

Speaker
(BR)

Console
(BR)

BR Device

BR Device

BR Device

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RAD-Gigastar

Dual Active Tap for Automotive Ethernet

- Dual Active Tap
  - 2x 100/1000BASE-T1 (Marvell)
  - 2x SFP cages for 100BASETX / 1000BASE-T / 1000BASE-X
- 6x CAN / CAN-FD
- 2x FlexRay (Rx Only)
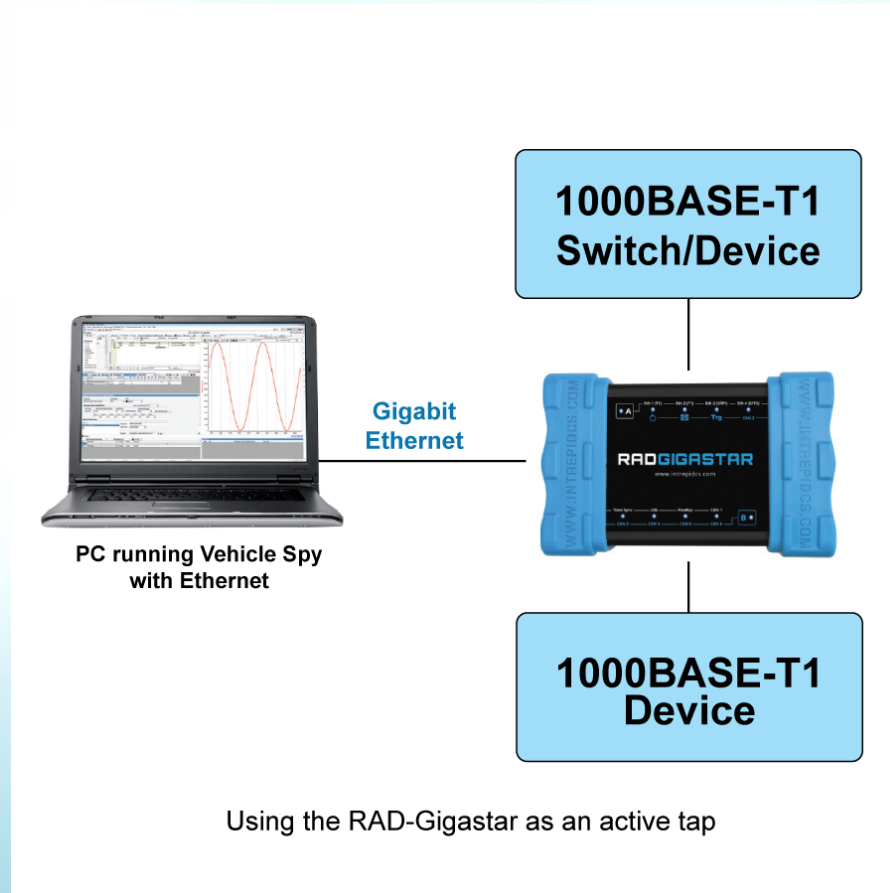- 1x SerDes (FPD Link / GMSL)
- 1x LIN/K-Line/DoIP Activation Line

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RAD-Gigastar Use Cases

1000BASE-T1 Switch/Device

PC running Vehicle Spy with Ethernet

Gigabit Ethernet

RADGIGASTAR

1000BASE-T1 Device

Using the RAD-Gigastar as an active tap

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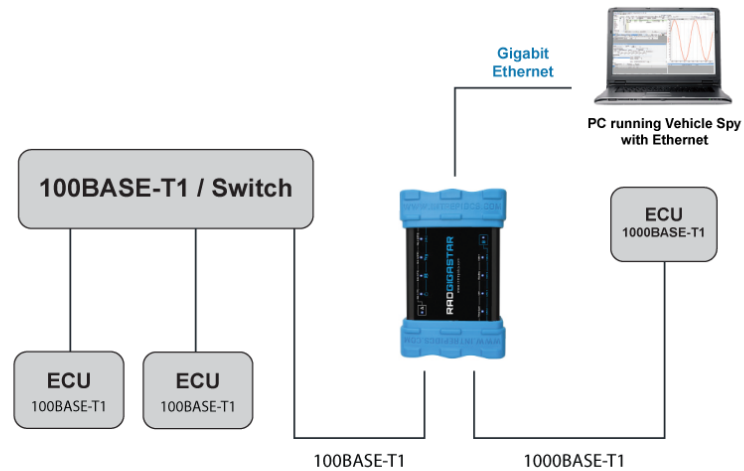# RAD-Gigastar Use Cases

Using the RAD-Gigastar as a media converter

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Can you transmit in the middle?

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Can you transmit in the middle?

Yes!

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Ethernet and the Central Gateway Module

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Ethernet Adds Challenges

- Hacking and third-party devices via the OBD port is forcing us all to use some sort of protective gateway

- The "Central" Gateway concept includes:

  - Protection of OBD Port

  - Gateway between networks

  - Servicing OBD J1979 requests

- Ethernet adds an additional challenge

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Latency, Throughput, DoIP

- Testing of throughput will be needed

- Latency testing will be required

  - CAN-to-CAN

  - CAN-to-Ethernet

  - Ethernet-to-Ethernet

- Latency testing requires accurate timestamp from a single piece of hardware

- Testing of DoIP will also be needed eventually (Diagnostics over IP)

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Questions?

Sales:

icssales@intrepidcs.com
+1 (586) 731-7950 x 2

Technical Support:

icssupport@intrepidcs.com
www.intrepidcs.com/support
+1 (586) 731-7950 x 1

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