Carrier-Grade Routing Solution Brief: Deploying Custom Web API Network Integration Guide for PDFs

CARRIER-GRADE ROUTING SOLUTION BRIEF: DEPLOYING CUSTOM WEB API NETWORK INTEGRATION GUIDE FOR PDFS

EXECUTIVE SUMMARY

This document serves as the definitive technical reference for network architects and systems engineers integrating carrier-grade routing infrastructure with custom web API workflows, specifically tailored for automated PDF generation, distribution, and secure document exchange. The solution presented herein leverages a high-performance, modular routing platform designed to handle the unique traffic patterns, security requirements, and quality-of-service (QoS) demands associated with API-driven document services in both enterprise and service provider environments.

The integration framework described in this guide enables seamless interoperability between RESTful/GraphQL API endpoints, backend document rendering engines, and secure storage repositories, while maintaining wire-speed forwarding, sub-millisecond latency, and carrier-class reliability. This solution is validated for deployments ranging from campus backbone aggregation to hyperscale datacenter leaf-spine architectures, ensuring

consistent performance across diverse operational contexts.



HARDWARE ARCHITECTURE & SILICON

The foundation of this integration guide is built upon a purpose-built, non-blocking switching fabric that incorporates a fifth-generation network processor unit (NPU) with integrated security accelerators. The hardware platform features a modular chassis design with redundant supervisor modules, fabric cards, and line cards, delivering up to 25.6 Tbps of switching capacity in a compact 4RU footprint.

Critical to the API integration workflow is the platform's deep packet inspection (DPI) engine, which operates at line rate and can classify API traffic based on HTTP/HTTPS headers, JSON payload signatures, and MIME types (including

application/pdf). The DPI engine works in concert with an intelligent traffic steering module that can direct API requests to dedicated virtual routing and forwarding (VRF) instances, ensuring tenant isolation and policy-based routing for PDF generation workloads.

The silicon architecture includes:

- A 24-core packet forwarding engine with hardware-accelerated TLS 1.3 offload
- Dedicated compression/decompression engines for gzip and Brotli, reducing PDF payload sizes in transit
- Programmable match-action tables (P4-capable) for custom API header parsing and load-balancing decisions
- Integrated hardware timestamping (IEEE 1588v2) for precise latency measurement and SLA monitoring

The thermal design incorporates front-to-back airflow with variable-speed fans, supporting operating temperatures from 0 °C to 45 °C, with a mean time between failures (MTBF) exceeding 250,000 hours at 25°C ambient.

KEY FEATURES & ROUTING LOGIC

- Feature 1: Dynamic API Endpoint Load Balancing: Hardware-based layer 4-7

load balancing distributes incoming API requests across multiple PDF generation servers based on real-time server health, response time, and session affinity (sticky sessions via cookie insertion). Supports weighted round-robin, least-connections, and consistent hashing algorithms.

- Feature 2: PDF-Specific Traffic Shaping & QoS: Advanced queueing disciplines (CBWFQ, LLQ) with deep buffer management (up to 32 GB shared packet buffer) prioritize API control plane traffic (e.g., authentication, metadata queries) over bulk PDF transfer, ensuring sub-50ms response times for interactive API calls even under saturated link conditions.

- Feature 3: Secure API Gateway Integration: Native integration with OAuth 2.0 and OpenID Connect (OIDC) via hardware-accelerated JWT validation, including support for RS256, ES256, and HS256 signatures. The platform performs API key rotation and token introspection at wire speed, reducing latency overhead to under 1 microsecond per validation.

- Feature 4: Automated PDF Routing & Transformation: Policy-based routing (PBR) rules can direct PDF documents to specific security zones (e.g., DMZ for external sharing, internal storage for archival) based on metadata extracted from the HTTP request, such as user role, department, or document classification. The platform can also apply header-based transformation for

CDN integration.

- Feature 5: Comprehensive Observability & Telemetry: Streaming telemetry via gRPC/Protobuf exports per-flow metrics for API transactions, including HTTP response codes, PDF payload sizes, transfer durations, and retry rates. Integration with Prometheus and Grafana enables real-time dashboards and automated alerting for API performance degradation.

- Feature 6: Redundancy & High Availability: Supports N+1 power supplies, M+N fabric redundancy, and stateful failover for all API sessions via the Virtual Router Redundancy Protocol (VRRP) and bidirectional forwarding detection (BFD). Hitless software upgrades (ISSU) minimize maintenance windows for mission-critical PDF delivery services.

COMPLIANCE & STANDARDS

The solution adheres to the following industry standards and regulatory frameworks, ensuring interoperability and audit readiness for PDF API integration:

- IEEE 802.1Q (VLAN tagging), 802.1ad (Q-in-Q), 802.3x (flow control), and 802.3az (Energy Efficient Ethernet)

- IETF RFCs: 2547 (L3VPN), 4364 (BGP/MPLS IP VPN), 4684 (VPN route target filtering), 5036 (LDP), 5880 (BFD), 6514 (BGP/MPLS IP VPN with PIM), 7432 (EVPN), and 8200 (BGPsec)

- Security: FIPS 140-2 Level 2 certified cryptographic module, compliant with PCI DSS v3.2.1 for secure API payment workflows, and GDPR/CCPA data protection requirements for handling personal data within PDFs

- Compliance: RoHS, WEEE, REACH, and China RoHS for environmental regulation; NEBS Level 3 certified for central office deployments

- API Standards: Fully interoperable with OpenAPI Specification 3.0, gRPC, and GraphQL; supports HTTP/2 and HTTP/3 (QUIC) for reduced latency in PDF transmission

- Energy Efficiency: ETSI EN 300 019-1-1 (environmental classes) and 80 PLUS Titanium power supply efficiency (>96% at 50% load)

TECHNICAL SPECIFICATIONS

The following parameters define the hardware and software capabilities relevant to the Custom Web API Network Integration Guide for PDFs. All values represent typical performance under lab-verified conditions.

- Switching Fabric Capacity: 25.6 Tbps (non-blocking, full-duplex)

- Forwarding Rate: 5.6 Bpps (billion packets per second) for 64-byte frames

- Packet Buffer: 32 GB shared, dynamically allocated per port/queue

- CPU: Dual Intel Xeon Scalable processors (16 cores total) for control plane operations

- Memory: 128 GB DDR4 ECC RAM, 2 x 480 GB SSD for persistent storage

- Interfaces: 48 x 25G SFP28, 8 x 100G QSFP28, 2 x 10G SFP+ (dedicated management)

- Power Supply: Dual, hot-swappable, 1100W AC or 1300W DC, 1+1 redundancy

- Cooling: Five hot-swappable fan trays with N+1 redundancy, airflow direction front-to-back

- Dimensions (H x W x D): 4.37 in (2U) x 17.5 in x 22.5 in (standard 19-inch rack)

- Weight: 28 lbs (fully populated)

- Operating Temperature: 0°C to 45°C (32°F to 113°F), 5% to 95% relative humidity (non-condensing)

- Storage Temperature: -40°C to 70°C (-40°F to 158°F)

Parameter	**Specification**
Form Factor	Modular 4RU Chassis (19-inch rack mountable)
Switching Capacity	25.6 Tbps non-blocking, full-duplex
Forwarding Rate	5.6 Bpps (billion packets per second)
Packet Buffer	32 GB shared, dynamically allocated
CPU	Dual Intel Xeon Scalable (16 cores

	total)
Memory / Storage	128 GB DDR4 ECC RAM / 2x 480 GB SSD (RAID 1)
Fixed Interfaces	2x 10G SFP+ (management ports)
Modular Interface Slots	8 line card slots (mix of 25G SFP28 and 100G QSFP28)
Max Port Density	192 x 25G SFP28 + 8 x 100G QSFP28, or 64 x 100G QSFP28
Power Supply	Dual hot-swappable, 1+1 redundant, 1100W AC or 1300W DC
Cooling	5 hot-swappable fan trays, N+1 redundancy, front-to-back airflow
Dimensions (HxWxD)	4.37 in (2U) x 17.5 in x 22.5 in
Weight	28 lbs (fully populated)
MTBF	250,000 hours at 25°C ambient
Operating Environment	0 ° C to 45 ° C, 5% to 95% RH (non-condensing)
Compliance	FIPS 140-2 Level 2, NEBS Level 3, RoHS, WEEE, REACH, PCI DSS
API Protocols	REST/GraphQL/gRPC, HTTP/2, HTTP/3, OpenAPI 3.0
Security Features	TLS 1.3 offload, JWT validation, OAuth

	2.0/OIDC, MACsec

ORDERING SKU INFORMATION

This section provides the base ordering codes and optional expansion modules for configuring the platform to meet specific PDF API integration requirements. Contact your local sales representative for custom configurations and bundled software licenses.

- Base Chassis (includes supervisor, backplane, fan tray): CR-API-4RU-BASE – Integrated hardware chassis with redundant supervisor slots (2).

- 25G SFP28 Line Card (24-port): CR-API-LC-24SFP28 – For high-density API endpoint connectivity. Supports SR, LR, and DAC cables.

- 100G QSFP28 Line Card (4-port): CR-API-LC-4QSFP28 – For uplink to core/distribution layers or to CDN/cloud providers.

- API Acceleration Module: CR-API-ACCEL – Dedicated hardware for TLS offload, JWT validation, and JSON parsing – recommended for high-volume PDF APIs.

- Power Supply (AC, 1100W): CR-PSU-AC-1100 – Hot-swappable, 1+1 redundancy recommended.

- Power Supply (DC, 1300W): CR-PSU-DC-1300 – For central office and

datacenter deployments.

- Software License – API Integration Suite: CR-SW-API-INT – Enables advanced DPI, PBR, and telemetry for PDF API workflows.

- Software License – High Availability: CR-SW-HA – For stateful failover and ISSU functionality.

- Optics: SFP28 SR (850nm, 25G), SFP28 LR (1310nm, 25G), QSFP28 SR4 (850nm, 100G), QSFP28 LR4 (1310nm, 100G) – order separately.

Note: All SKUs include a 1-year hardware warranty with next-business-day advance replacement. Extended service and 24/7 premium support options are available.

