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Adaptive Semantic-Aware Traffic Management in ASP.Net Core: A Contextual Framework for Dynamic Routing and Risk-Based Request Prioritization

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Abstract: *In modern web applications, dynamic traffic shaping based on user context is essential for optimizing performance, enhancing security, and delivering personalized experiences. This thesis proposes a semantic-aware traffic management framework in ASP.NET Core that leverages contextual metadata—such as geolocation, device type, user roles, and historical session behavior—to inform adaptive routing decisions at runtime. By integrating custom middleware, OpenTelemetry-based observability, and policy-driven routing mechanisms, the system dynamically adjusts request flows across distributed microservices. An embedded risk evaluation engine assesses incoming requests using metadata and behavioral heuristics, triggering route prioritization or reallocation based on perceived threat levels or operational load. Semantic tagging enriches request headers, enabling more granular control and intelligent filtering within the reverse proxy layer powered by YARP. The architecture supports scalable deployment on containerized environments using Kubernetes and Azure App Gateway for high availability and traffic governance. Comprehensive testing demonstrates measurable improvements in response time, system resilience, and threat mitigation. This work contributes a robust and extensible approach to context-aware traffic orchestration within enterprise-grade .NET ecosystems, aligning with evolving demands for adaptive, secure, and responsive web infrastructures*

Keywords: ASP.NET Core, adaptive routing, context-aware computing, semantic metadata, traffic shaping, middleware architecture, microservices, risk-based request prioritization, OpenTelemetry, YARP, reverse proxy routing, dynamic request management, Kubernetes, Azure Application Gateway, web application security