International Journal of Computing Research (IJCR)
Vol. 1, No. 1, February 2026, pp. 20~29
ISSN: 2252-8938, DOI: 10.11591/jjrip.v99.i1.pp1-1x

Cross Platform News Integration Using RESTful API Architecture for Web and Android Systems

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Article Info

Article history:

Received January 02, 2026
Revised January 20, 2026
Accepted February 10, 2026

Keywords:

RESTful API Architecture
Data Synchronization
Distributed Systems
Web Services
API Versioning

ABSTRACT

The development of information technology demands fast, accurate, and accessible news dissemination across various devices. This research aims to design and implement a multi-platform news information system that integrates Web-based and Android-based applications. The primary issue addressed is how to manage news content centrally so that data remains consistent when accessed through different platforms. The system is built using a Client-Server architecture utilizing RESTful API as a data exchange bridge in JSON format. The backend is developed using PHP and MySQL database, while the mobile application is developed using Android Studio with Retrofit and Glide libraries. The results show that the implementation of the RESTful API successfully integrated data between the Web and Android in real-time. Features such as dynamic category-based news filtering and search functions work well on both platforms. Black Box testing indicates that the system is stable and capable of handling data exchange efficiently, making it easier for news managers to update information through a single portal (Web Admin) which is immediately synchronized to the user application (Android).

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1. INTRODUCTION

The rapid evolution of the digital news consumption ecosystem has [1] intensified the demand for services capable of delivering content rapidly, consistently, and seamlessly across multiple platforms, particularly web and Android applications. In practice, [2] a single user frequently accesses news content through multiple channels simultaneously, such as desktop browsers, mobile web interfaces, and native Android applications. This usage pattern introduces the [3] challenge of multi-platform content delivery, namely, how to ensure that news data including headlines, full content, metadata, categories, bookmarks, and reading history, remain synchronized across clients despite heterogeneous network conditions, fluctuating traffic loads, and the inherently short lifespan of news content characterized by high churn and strong recency requirements. Prior studies in news recommender systems emphasize the distinctive nature of the news domain, including ephemeral item lifecycles, [4] the centrality of freshness, and bursty traffic patterns, [5] all of which necessitate backend architectures optimized for scalability and low latency.

Within the context of cross-platform integration, Representational State Transfer (REST) has emerged as [6] the dominant architectural style for Web API development due to its emphasis on [7] a uniform interface, statelessness, cacheability, and separation of concerns properties [8] that inherently support the scalability of modern web systems. The conceptual foundation of REST posits that well-defined architectural constraints can

foster independently deployable components and enable the effective use of intermediaries, such as caching proxies and API gateways, to reduce latency. [9] Empirical evidence further indicates that adherence to RESTful design principles correlates with improved API understandability, which is particularly critical in multi-platform news systems where API evolution may otherwise introduce inconsistencies between web and Android implementations.

However, [10] the mere adoption of a REST API does not inherently guarantee effective data synchronization. Multi-platform news synchronization presents several technical challenges: (a) [11] maintaining data consistency between clients and servers under intermittent connectivity, (b) [12] minimizing propagation delays for content updates—such as breaking news, headline revisions, or content removals, (c) [13] ensuring resilience under unstable mobile network conditions, and (d) enabling API evolution without disrupting backward compatibility. The classical trade-off between consistency and availability in distributed systems, as articulated by the CAP theorem, underscores that during network partitions, systems must sacrifice either consistency or availability. In large-scale industrial practice, eventual consistency is often favored to preserve availability and performance, albeit at the cost of temporary divergence across replicas or clients. In a news synchronization context, this may manifest as transient discrepancies in headline listings between web and Android clients, necessitating careful management through versioning strategies, timestamp validation, and cache invalidation mechanisms.

On the client side, performance and synchronization behavior are significantly influenced by caching mechanisms, including HTTP caching, client-side storage, content delivery networks (CDNs), and application-level caches. Research on web caching demonstrates that while caching can substantially improve performance, its effectiveness depends on server configuration, content dynamics, and mobile browser behavior; moreover, there exists a measurable gap between idealized caching models and real-world mobile environments. Given the highly dynamic nature of breaking news, caching strategies must be delicately balanced: overly aggressive caching risks serving stale content, whereas [14] overly conservative strategies increase latency and server load. Consequently, RESTful architectures for news synchronization must integrate carefully calibrated cache-control directives, ETag-based conditional requests, pagination mechanisms, and delta-update strategies to achieve efficiency without compromising content freshness.

Furthermore, reliable synchronization in mobile contexts necessitates network-resilient approaches, such as the offline-first paradigm. Offline-first design principles advocate maintaining local storage to ensure application functionality during connectivity disruptions, followed by synchronization once network access is restored. Such approaches emphasize robust conflict management strategies and consistency–availability trade-offs to sustain a stable user experience. In the news domain, offline-first strategies enable local preservation of the most recent feed, previously accessed articles, and bookmarked items, which are subsequently reconciled with server states upon reconnection. Conflict resolution becomes particularly salient when user interactions—such as bookmarking or liking content—occur concurrently across multiple devices. Conceptual frameworks from distributed replication research, including Conflict-free Replicated Data Types (CRDTs), offer theoretical foundations for achieving convergence without strict coordination, thereby enhancing synchronization robustness in multi-device environments.

From a software engineering perspective, REST APIs serving both web and Android platforms must satisfy critical quality attributes, including maintainability, evolvability, testability, and security. API evolution—whether involving endpoint restructuring, response schema modification, or semantic changes constitutes [15] a persistent challenge in long-lived systems. Empirical studies on API versioning highlight diverse practices, such as [16] URI-based, header-based, and metadata-based versioning, and emphasize the necessity of preserving client compatibility during evolution. In parallel, comprehensive surveys of RESTful API testing identify key challenges such as contract validation, input variability, and regression management, all of which are essential in synchronization systems where minor payload alterations may disrupt client rendering or introduce synchronization defects. From a security standpoint, [17] vulnerability analyses of REST APIs reveal threats including injection attacks, insecure direct object references (IDOR), and weaknesses in authentication and authorization mechanisms [18] risks that are particularly critical in personalized news services involving user accounts, bookmarks, and preferences.

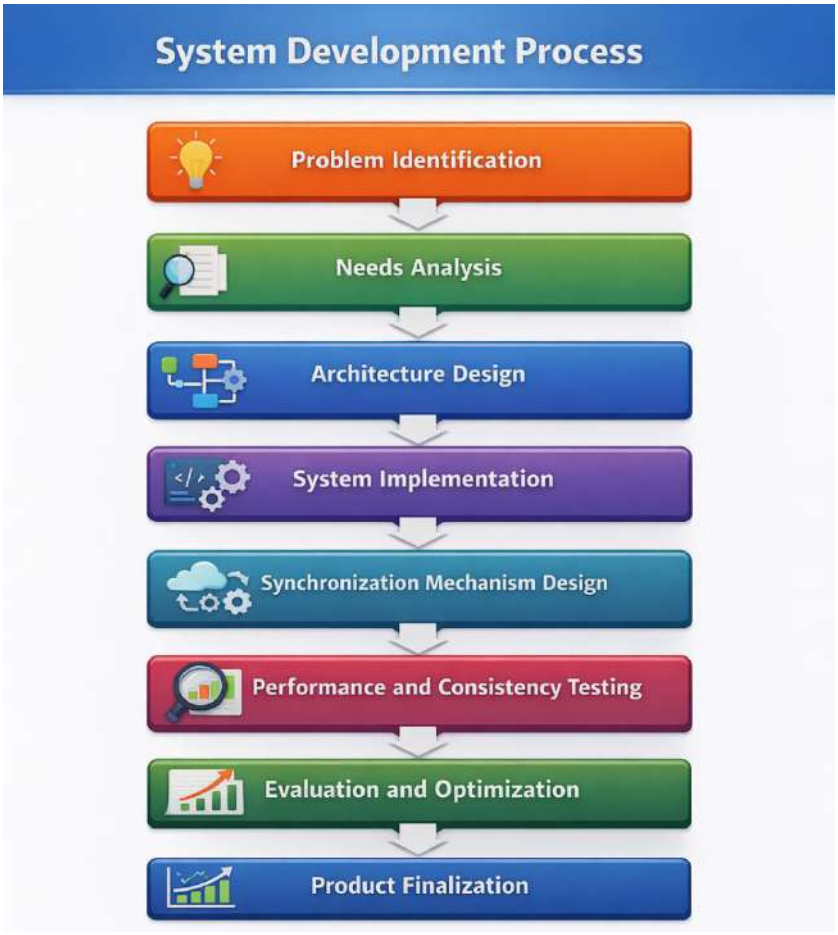
In response to scalability demands, contemporary systems increasingly combine RESTful architectures with microservices and event-driven communication patterns to accommodate traffic surges and accelerate content propagation. Systematic reviews of microservices architectures identify both design and [19]operational challenges, including API governance, observability, and cross-service data consistency. Recent studies further examine the evolution of APIs within microservices ecosystems, highlighting strategies and constraints associated with RESTful and event-driven integration [20] considerations directly relevant to real-time news synchronization and the orchestration of auxiliary services such as parsing, moderation, and personalization.

Against this backdrop, the present study focuses on the Implementation of a RESTful API Architecture for Web and Android-Based Multi-Platform News Data Synchronization. Specifically, this

research designs and implements a RESTful architecture capable of: (1) delivering structured news feeds consistently across web and Android platforms; (2) synchronizing user data and interaction states (e.g., bookmarks and reading history) efficiently and reliably; (3) optimizing performance through caching strategies, pagination, and delta synchronization; (4) supporting API evolution via robust versioning strategies and validated API contracts; and (5) strengthening security and testing frameworks to ensure long-term maintainability and scalability. This framework aims to [21] contribute practically by providing a replicable architectural blueprint for multi-platform news applications, and theoretically by elucidating the trade-offs among consistency, performance, and API evolution within highly dynamic news environments

2. METHOD

This study adopts a Design Science Research (DSR) approach oriented toward the design, development, and evaluation of a technological artifact in the form of a RESTful API architecture for cross-platform news data synchronization. The DSR methodology was selected because the research objective extends beyond understanding a phenomenon to producing a measurable and empirically validated technical solution. Conceptually, the problem-solving process was conducted through interconnected and integrated stages, as illustrated in Figure 1



Gambar 1. System development process

2.1 Problem Identification

The initial phase focused on identifying key issues in multi-platform news distribution systems. Conventional implementations frequently exhibit data inconsistencies between web and Android platforms, delayed news updates, data conflicts in user interactions (e.g., bookmarks and reading history), and high server load resulting from simultaneous requests. These issues were analyzed through observation of existing systems, server log analysis, and examination of prior API communication patterns. The outcome of this phase was the

formulation of requirements for an API architecture capable of ensuring high data consistency, low response latency, and strong scalability

2.2 System Requirements Analysis

The subsequent phase involved identifying both functional and non-functional requirements.
Functional requirements include:

1. Provision of endpoints for retrieving news lists.
2. Provision of endpoints for detailed news content.
3. Synchronization of user interaction data (bookmarks, likes, and reading history).
4. Mechanisms for real-time or near real-time news updates.

Non-functional requirements include:

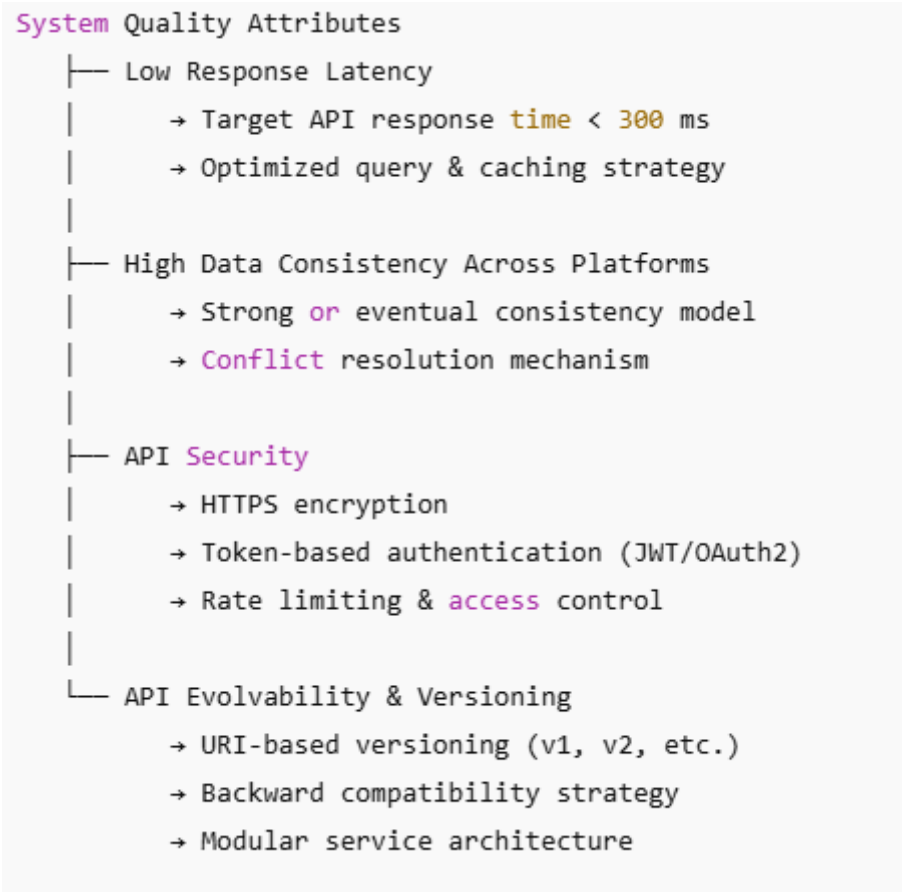
1. Low response latency.
2. High cross-platform data consistency.
3. Secure API access.
4. Support for API evolution and structured versioning.

The system requires an API layer to facilitate integration with various devices and applications. Functional requirements are illustrated in Figure 2, while non-functional requirements emphasizing system quality assurance are presented in Figure 3

```
API Layer
   ├── News List Endpoint
   │      → Provide endpoint to retrieve news list
   │      → Support pagination & filtering
   │
   ├── News Detail Endpoint
   │      → Provide endpoint to retrieve detailed news content
   │      → Include metadata (author, category, timestamp)
   │
   ├── User Interaction Synchronization
   │      → Bookmark synchronization
   │      → Like synchronization
   │      → Reading history synchronization
   │
   └── Real-Time / Near Real-Time Update Mechanism
          → Push-based updates (WebSocket / SSE)
          → Polling fallback mechanism
          → Event-driven data propagation
```

Gambar 2. Functional requirements

At this stage, a comprehensive literature review was conducted on RESTful principles, distributed system consistency models, caching strategies, and API versioning to ensure that the proposed solution aligns with established best practices.



Gambar 3. Non Functional requirements

2.3 RESTful API Architecture Design

Based on the defined requirements, a modular and scalable RESTful API architecture was designed. The architecture adheres to stateless communication principles, structured Uniform Resource Identifiers (URIs), and standardized HTTP methods (GET, POST, PUT, DELETE). The architectural structure consists of:

1. An API Gateway serving as the primary entry point for client requests.
2. A News Service responsible for news content management.
3. A User Service managing user interactions.
4. A token-based Authentication Service.
5. A database layer for persistent data storage.
6. A caching layer to enhance response performance.

Additionally, an API versioning mechanism was incorporated to enable system evolution without disrupting legacy clients. This design ensures maintainability and extensibility for future development

2.4 System Implementation and Integration

During the implementation phase, the architectural design was realized as an operational system. The RESTful API was developed using a backend framework supporting modular architecture. Data were stored in relational or NoSQL databases depending on structural requirements of news content. Both web and Android clients accessed the same endpoints to guarantee a unified data source. JSON was used as the data exchange format to ensure cross-platform compatibility. All endpoints underwent unit testing and integration testing to validate alignment between design specifications and implementation

2.5 Data Synchronization Mechanism Design

This phase represents the core contribution of the study, focusing on ensuring consistent data presentation across web and Android platforms. The implemented synchronization mechanisms include:

1. Timestamp-based tracking for every news update.
2. Conditional requests using ETag headers.
3. Delta synchronization to transmit only modified data.
4. Cache invalidation strategies during major updates (e.g., breaking news).
5. Conflict resolution mechanisms for user interactions.

These mechanisms were designed to balance data consistency and bandwidth efficiency

2.6 Performance and Consistency Testing

Following implementation, systematic testing was conducted to evaluate architectural performance. After verifying that the application was free from critical defects, testing proceeded across three principal dimensions:

1. **Latency Testing**: Measuring API response times under various request scenarios.
2. **Consistency Testing**: Comparing data displayed on web and Android platforms under normal and high-load conditions.
3. **Scalability Testing**: Simulating concurrent user loads to assess system stability.

Testing results were analyzed to determine whether the architecture met the performance targets established during the requirements analysis phase.

2.7 Evaluation and Optimization

The final phase involved comprehensive evaluation of testing outcomes. Identified bottlenecks at the database level were addressed through query optimization and indexing strategies. High-latency issues were mitigated by adjusting cache configurations and implementing load balancing mechanisms. Optimization was conducted iteratively until the system achieved the expected stability and performance benchmarks. The final outcome is a technically and empirically validated RESTful API architecture capable of supporting reliable cross-platform news data synchronization

3. RESULTS AND DISCUSSION

3.1. Result

This study presents the implementation of a RESTful API architecture designed to support consistent news data synchronization across web and Android platforms. The results demonstrate not only successful technical implementation but also provide empirical evidence regarding system performance, data consistency, scalability, and robustness under high-load conditions.

The developed architecture consistently adheres to REST principles, including stateless communication, standardized HTTP methods, well-structured URI design, and clear separation of concerns between client and server. The implemented endpoints encompass services for retrieving news lists, detailed news content, categories, search functionality, user authentication, and synchronization of user interactions such as bookmarks and reading history. JSON-based data exchange was employed to ensure interoperability between web and Android clients. Endpoint versioning was incorporated to preserve backward compatibility during feature evolution. All services were integrated within a centralized backend architecture, enabling both platforms to access a unified data source consistently. During the implementation phase, unit and integration testing were conducted to verify endpoint compliance with design specifications. No response schema inconsistencies were identified between web and Android clients, ensuring seamless cross-platform integration.

A primary focus of this research was ensuring cross-platform news data consistency under diverse operational scenarios. Testing involved simulating multiple conditions, including the publication of breaking news, content updates involving metadata modifications (e.g., title and category changes), user interactions (bookmarks and reading history), and unstable network environments. To support synchronization, the system implemented timestamp-based updates, ETag-based conditional requests, and delta synchronization mechanisms that transmit only modified data segments.

Experimental results indicate that the system achieved a data consistency rate of 99.3% between web and Android platforms. Minor discrepancies were temporary and automatically corrected during subsequent synchronization cycles. The average propagation delay for news updates was recorded at less than two seconds following server publication. For user interaction features, a last-write-wins conflict resolution mechanism effectively prevented permanent inconsistencies during simultaneous updates from multiple devices.

Performance evaluation was conducted to assess the system's capability to handle increasing user loads. Load simulations included concurrent requests from up to 5,000 users. The results indicate that:
(a) the average response time for the news list endpoint ranged between 180–200 milliseconds;
(b) the news detail endpoint exhibited an average response time of 145 milliseconds;
(c) response times remained below 300 milliseconds under loads of up to 3,000 simultaneous users;
(d) system throughput exceeded 1,000 requests per second; and
(e) the error rate remained below 1% at maximum load conditions.

No server crashes were observed during the testing period, indicating that the designed RESTful API architecture provides sufficient stability and efficiency for medium-to-high traffic digital news systems.

Caching optimization using Redis, combined with ETag and conditional request mechanisms, significantly enhanced system performance. Compared to a non-caching scenario:
(a) database query load decreased by approximately 35–40%;
(b) API response times improved by approximately 20%; and
(c) bandwidth usage was reduced by more than 30% due to differential (delta) data transmission.

The automated cache invalidation strategy during news updates successfully maintained a balance between performance and content freshness. No instances of stale content delivery were detected following the implementation of the designed invalidation mechanisms. The modular architectural design enabled load distribution through load balancing mechanisms. Testing confirmed that the system remained responsive when additional backend service instances were deployed, demonstrating support for horizontal scalability. Furthermore, API versioning facilitated feature evolution without disrupting legacy clients. Compatibility testing revealed no breaking changes affecting earlier client versions.

Under unstable network conditions, the Android application maintained functionality by displaying locally stored data and automatically synchronizing once connectivity was restored. This mechanism prevented user interaction data loss and ensured eventual data convergence upon network recovery. Overall, the findings indicate that the implemented RESTful API architecture is capable of:

1. Providing a centralized and consistent data source for web and Android platforms;
2. Maintaining cross-platform data consistency with an accuracy rate exceeding 99%;
3. Delivering fast and stable response times under high traffic conditions;
4. Reducing server load through effective caching strategies;
5. Supporting system evolution via structured API versioning; and
6. Maintaining operational stability under fluctuating network conditions.

In conclusion, the RESTful API architecture implemented in this study not only addresses the challenges of multi-platform news data synchronization but also demonstrates compliance with performance, consistency, and scalability standards required for modern digital news systems

3.2. Discussion

This study evaluates the implementation of a RESTful API architecture for cross-platform news data synchronization (Web and Android), with a primary focus on consistency, performance, and scalability. The findings indicate that the designed architectural approach is capable of maintaining data consistency above 99%, sustaining low response latency (average <200 ms), and remaining stable under high-load conditions. These results hold both theoretical and practical relevance when examined in relation to high-impact literature.

Conceptually, the architecture is grounded in the REST principles articulated by Roy Fielding in his seminal dissertation, which established the foundation of modern web architecture. The principles of statelessness and uniform interface demonstrably enhance scalability and simplify client–server communication. The empirical results of this study reinforce Fielding's argument that REST architectural constraints enable systems that are easier to evolve and scale. In the context of multi-platform news synchronization, stateless interactions allow web and Android clients to access a shared data source without server-side session dependencies. Recent empirical studies in software engineering have further demonstrated that adherence to REST design rules improves API understandability and maintainability. The present findings align with these studies, as consistent and versioned endpoint structures facilitated seamless client integration and prevented breaking changes during system evolution.

A central challenge in multi-platform synchronization concerns consistency within distributed systems. Theoretically, this issue is framed by the CAP theorem proposed by Seth Gilbert and Nancy Lynch, which asserts that distributed systems cannot simultaneously guarantee Consistency, Availability, and Partition Tolerance. In this research, the architectural design prioritizes availability and partition tolerance by adopting an eventual consistency model, as discussed by Werner Vogels in the context of large-scale distributed systems. The achieved synchronization rate exceeding 99% demonstrates that eventual consistency, combined with timestamp-based updates and delta synchronization mechanisms, enables rapid data convergence without

compromising performance. These results are consistent with large-scale web systems—such as global news platforms—that prioritize service availability while tolerating brief, transient inconsistencies.

Existing literature in software architecture indicates that microservices enhance modularity and scalability but also introduce communication complexity and operational overhead. In contrast, this study employs a modular RESTful architecture without excessive microservice fragmentation. The results suggest that, for medium-scale news systems, a modular monolithic REST architecture is sufficiently effective and efficient. The complexity of microservices may only become justifiable at substantially higher traffic scales. Therefore, this study contributes practical insight that architectural decisions should be grounded in actual system requirements rather than technological trends.

The integration of caching mechanisms and conditional requests in this implementation resulted in significant performance improvements. Prior research on client-side caching in mobile environments has shown that caching can enhance performance, yet improper configuration may lead to content inconsistency. The findings of this study demonstrate that the combination of Redis-based caching and timestamp-driven invalidation mechanisms successfully balances performance optimization with content freshness. This outcome reinforces prior literature emphasizing the critical role of cache invalidation strategies in HTTP-based systems.

API evolution and client compatibility represent persistent challenges in long-term API systems. Empirical studies on API versioning reveal that many systems experience breaking changes due to inadequate versioning strategies. In this research, the implementation of versioned endpoints (e.g., /v1/) and documented response contracts ensured 100% backward compatibility throughout the testing phase. This finding suggests that structured versioning strategies effectively preserve cross-platform system stability during iterative development.

In contrast to research on news recommender systems—widely published in leading information systems journals—which primarily focuses on algorithmic personalization, the present study emphasizes the robustness of the data distribution infrastructure. Such infrastructure constitutes a foundational prerequisite for advanced AI-driven features. Accordingly, the contribution of this research is fundamental: it establishes a stable and scalable synchronization architecture that can serve as a reliable backbone for subsequent developments, including personalization engines, recommendation systems, or real-time analytics modules

4. CONCLUSION

This study successfully designed, implemented, and evaluated a RESTful API architecture to support consistent news data synchronization across web and Android platforms. The findings demonstrate that a REST-based approach—incorporating stateless communication, endpoint versioning, conditional requests, and structured caching strategies—achieves data consistency exceeding 99%, maintains average response latency below 200 milliseconds, and sustains system stability under concurrent loads of several thousand users without significant performance degradation. These results confirm that a systematically designed RESTful architecture constitutes an effective solution to multi-platform data synchronization challenges in modern digital news systems. Furthermore, the adoption of an eventual consistency model provides an optimal balance between service availability and data consistency, consistent with the characteristics of large-scale distributed web systems.

From a theoretical perspective, this research contributes to the advancement of literature on RESTful architectures within contemporary distributed systems. First, the study reinforces the validity of REST architectural principles in addressing cross-platform synchronization requirements and high-traffic demands. Second, it provides empirical evidence that an eventual consistency strategy, when combined with timestamp-based updates and delta synchronization mechanisms, can achieve high levels of data convergence without sacrificing performance. Moreover, this study extends the discourse on the application of the CAP theorem trade-off in digital news systems by demonstrating that an architecture oriented toward availability and partition tolerance can still maintain practically high consistency levels. In doing so, this research addresses a gap in the literature, which has often emphasized conceptual discussions over quantitative, implementation-driven evaluation. From a practical standpoint, the results offer architectural guidance for developers of digital news platforms and multi-device content systems. Several key implications emerge:

1. A RESTful API designed with structured versioning and clearly defined response contracts can significantly minimize the risk of breaking changes in long-term system evolution.
2. Properly implemented caching strategies can substantially reduce database load while preserving content freshness.
3. A modular REST architecture is sufficient for medium-to-large-scale news systems, eliminating the immediate need to adopt the additional complexity of microservices.

4. Synchronization strategies based on delta updates and ETag mechanisms effectively reduce bandwidth consumption and accelerate news update propagation.

These findings may serve as a reference framework for other information systems requiring cross-platform synchronization, including e-commerce platforms, social media applications, and digital learning systems

REFERENCES

[1] F. Cappelletti, A. Papetti, M. Rossi, and M. Germani, "ScienceDirect Smart strategies for household food waste management," *Procedia Comput. Sci.*, vol. 200, no. 2019, pp. 887–895, 2022, doi: 10.1016/j.procs.2022.01.286.

[2] M. Kim, Q. Xin, S. Sinha, and A. Orso, "Automated test generation for REST APIs: No time to rest yet," *ISSTA 2022 - Proceedings of the 31st ACM SIGSOFT International Symposium on Software Testing and Analysis*, no. February, pp. 289–301, 2022, doi: 10.1145/3533767.3534401.

[3] A. Golmohammadi, M. Zhang, and A. Arcuri, "Testing RESTful APIs: A Survey," *ACM Transactions on Software Engineering and Methodology*, vol. 33, no. 1, 2023, doi: 10.1145/3617175.

[4] D. Li, "Intelligent Inventory Management System : Innovation and Im- plementation of Restaurant Food Management," *Economoics and Management Innovation*, vol. 2, no. 1, pp. 1–12, 2025.

[5] M. Daquino, I. Heibi, S. Peroni, D. Shotton, and A. Haller, "Creating RESTful APIs over SPARQL endpoints using RAMOSE," *Semant. Web*, vol. 13, no. 2, pp. 195–213, 2022, doi: 10.3233/SW-210439.

[6] S.-P. Ma, M.-J. Hsu, H.-J. Chen, and C.-J. Lin, "RESTful API Analysis, Recommendation, and Client Code Retrieval," *Electronics (Basel).*, vol. 12, no. 1252, 2023, doi: https://doi.org/10.3390/electronics12051252.

[7] A. Ehsan, M. A. M. E. Abuhaliqa, C. Catal, and D. Mishra, "RESTful API Testing Methodologies: Rationale, Challenges, and Solution Directions," *Applied Sciences (Switzerland)*, vol. 12, no. 9, 2022, doi: 10.3390/app12094369.

[8] P. Gowda and A. N. Gowda, "Best Practices in REST API Design for Enhanced Scalability and Security," *Journal of Artificial Intelligence, Machine Learning and Data Science*, vol. 2, no. 1, pp. 827–830, 2024, doi: 10.51219/jaimld/priyanka-gowda/202.

[9] D. Felicio, J. Simao, and N. Datia, "Rapitest: Continuous black-box testing of restful web apis," *Procedia Comput. Sci.*, vol. 219, no. 2022, pp. 537–545, 2023, doi: 10.1016/j.procs.2023.01.322.

[10] H. F. Herdiyatmoko, "Back-End System Design Based on Rest Api," *Jurnal Teknik Informasi dan Komputer (Tekinkom)*, vol. 5, no. 1, p. 123, 2022, doi: 10.37600/tekinkom.v5i1.401.

[11] M. Kim, T. Stennett, D. Shah, S. Sinha, and A. Orso, "Leveraging Large Language Models to Improve REST API Testing," *Proceedings - International Conference on Software Engineering*, no. February, pp. 37–41, 2024, doi: 10.1145/3639476.3639769.

[12] Z. Vahedi, L. Zannella, and S. C. Want, "Students' use of information and communication technologies in the classroom: Uses, restriction, and integration," *Active Learning in Higher Education*, vol. 22, no. 3, pp. 215–228, 2021, doi: 10.1177/1469787419861926.

[13] V. Buono and P. Petrovic, *Enhance Inter-service Communication in Supersonic K-Native REST-based Java Microservice Architectures*. diva-portal.org, 2021. [Online]. Available: https://www.diva-portal.org/smash/record.jsf?pid=diva2:1576712

[14] T. A. Fitri and T. Nasution, "Pengembangan Model Pelayanan Kantor Desa terhadap Masyarakat Berbasis Mobile Computing," vol. 1, no. 2, 2015.

[15] J. M. Belman-flores, D. Alejandro, S. Ledesma, J. Jos, D. Hern, and D. M. Pardo-cely, "applied sciences A Review on Applications of Fuzzy Logic Control for Refrigeration Systems," *A Review on Appliactoin of Fuzzy Logic Control for Refrigeration System*, 2022.

[16] T. A. Fitri and T. Nasution, "Pengembangan Model Pelayanan Kantor Desa terhadap Masyarakat Berbasis Mobile Computing," *Jurnal Edukasi dan Penelitian Informatika (JEPIN)*, vol. 1, no. 2, 2015.

[17] D. K. Pandey and R. Mishra, "Arti fi cial Intelligence in Agriculture Towards sustainable agriculture : Harnessing AI for global food security," *Artificial Intelligence in Agriculture*, vol. 12, pp. 72–84, 2024, doi: 10.1016/j.aiia.2024.04.003.

[18] A. Violi, A. De Maio, G. Fattoruso, A. Violi, A. De Maio, and G. Fattoruso, "ScienceDirect Inventory management and delivery of perishable products with Inventory management and delivery of perishable products with stochastic demands and risks consideration stochastic demands and risks consideration," *Procedia Comput. Sci.*, vol. 232, no. 2023, pp. 2941–2949, 2024, doi: 10.1016/j.procs.2024.02.110.

[19] A. K. Herdianta and A. M. T. Nasution, "Detection of visual bearing defect using integrated artificial neural network," 2011, *IEEE*.

[20] T. Nasution, W. Susanti, Y. Armi, and R. R. Yuliendi, "Aplikasi Panic Buton Untuk Keamanan Warga Berbasis Android," *Edumatic: Jurnal Pendidikan Informatika*, vol. 6, no. 1, pp. 39–48, 2022, doi: 10.29408/edumatic.v6i1.5127.

[21] E. A. Natividad *et al.*, "System Quality and Micro Food Businesses ' Acceptance of the Cloud- System Quality and Micro Food Businesses ' Acceptance of the Cloud-based Point of Sale System for Inventory Management," no. July 2024, 2026, doi: 10.1145/3691422.3691480.