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Optimizing SAP PLM ECTR for High-Volume CAD Data: Proven strategies for peak performance

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Abstract

When the engineering workforce is spread across geographical locations, the implementation of SAP Engineering Control Center (SAP ECTR) to store the engineering data in massive CAD assemblies may cause performance bottlenecks. These bottlenecks may be at the working stations, the networks, the SAP back-end systems, and even the content storage, which would affect the productivity and the processes further down the chain.

This is the offer the paper provides in terms of metrics, which will mean utilizing SAP guidelines, community best practices, and partner insight to improve the performance of SAP ECTR in high-volume CAD environments. It also includes the workflow optimization, the KPI standards, and architectural practices, which can be utilized in large engineering settings. The list of MCAD tools that could be integrated with SAP ECTR is lengthy and includes Autodesk AutoCAD, SOLIDWORKS, Siemens NX, PTC Creo, CATIA V5, and Solid Edge. The concepts discussed are applicable to any integrated tool, although Siemens NX is the primary example used in this paper.

Keywords: SAP PLM; SAP ECTR; SAP ERP; SAP S/4HANA; SAP R/3; ABAP backend; PDM; Content Server; Cache servers; OAC0; Key Performance Indicators (KPIs); Assembly Open Time (AOT); Check-In/Check-Out Round-Trip (CIRT); Knowledge Provider (KPro)

1. Introduction

SAP Engineering Control Center (ECTR) is a strategic integration tool that connects CAD authoring tools with SAP PLM and SAP ERP systems, such as SAP R/3 and S/4HANA, enabling companies to store engineering information, product structures, and engineering lifecycle processes within an integrated ERP solution. The ECTR interface supports multitask assemblies, multi-format CAD systems, and collaborative processes across geographically dispersed workgroups. However, the trend toward centralized PLM environments is replacing independent PDM systems.

Nevertheless, large-volume CAD data cannot always be effectively integrated and often faces severe performance issues. Large assemblies, which may exceed gigabytes in size, combined with distributed engineering sites and hybrid cloud/on-premises designs, can cause slow check-in/check-out times, excessive loading times, and network overload. Those issues not only affect engineering productivity, but also the downstream processes, such as BOM generation, change management, and manufacturing planning.

ECTR needs to be streamlined as a whole, including the client-side installation, network response, ABAP server performance, and content server stability in light of KPro. The paper attempts to address these issues by proposing a measurement-first approach and tuning solutions that are specifically applied in large-volume CAD systems. It also resorts to comparative analysis of storage, key performance measurements, and actionable checklists to ensure high

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performance of ECTR operations in global engineering networks at all times [1] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [17] [18].

2. Overview of SAP Engineering Control Center Architecture

SAP Engineering Control Center (SAP ECTR) is a wide-scoped program through which engineering tools can be integrated into SAP enterprise systems. It is designed as a layered architecture and has four major components that ensure scalability, flexibility, and data security.

2.1. Front-End Layer (SAP ECTR Client):

The SAP ECTR Client is installed on engineers' workstations and connected to CAD environments. This allows users to perform basic operations such as check-in/check-out, version control, and linking CAD information to SAP objects without leaving the design tools.

2.2. Backend Layer (SAP System)

The client is connected to the SAP backend (usually SAP S/4HANA or SAP ERP), where product information, Bills of Materials (BOMs), and lifecycle operations are managed.

2.3. Integration Layer

This layer between the client and the backend contains the PLM Integration Services and mapping logic. It is responsible for converting CAD structures into SAP business objects, including material and document information records, to ensure a smooth flow of data.

2.4. Storage Layer

Large files and document originals are stored in the SAP Content Server or an external repository, while metadata is stored in SAP to manage and control the lifecycle [1] [3] [4] [5] [6] [11] [12].

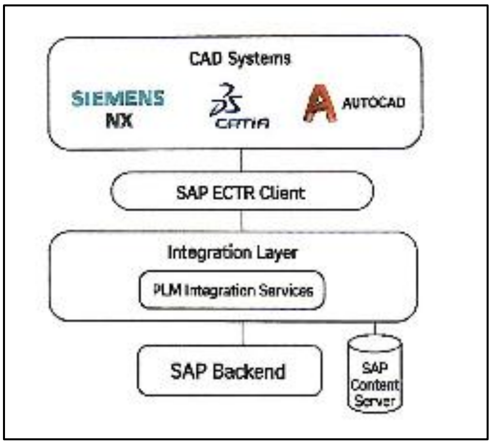

Figure 1 High-level architecture for SAP ECTR

3. Performance Optimization Framework: The Four-Step Approach

It is a performance-based process. This is recommended to be organized in a cyclic way in order to achieve the optimum results on the SAP ECTR performance in a large-scale CAD environment. The improvement process is created in an orderly manner and consists of four steps, namely analysis, optimizing methods, adding products/hardware, and continuous monitoring, where configuration and process inefficiency problems are resolved first and hardware investments are undertaken later.

The model presupposes four steps, to each of which is dedicated a specific activity: the Analysis stage is devoted to setting a performance baseline to be aware of the bottlenecks; the Optimize Methods stage is devoted to the cost-effective decisions under the circumstances of configuration and process tuning; the Add Products/Hardware stage is devoted to the introduction of the changes in the infrastructure when it is needed; and finally, the Continuous Monitoring stage is devoted to it.

This method minimizes speculation, concentrates on cost-effective solutions, and provides a feedback mechanism to ensure continuous optimization. This cycle enables companies to maintain high performance due to the concentration of CAD data and the expansion of collaboration on a global scale, without spending excessive and unreasonable resources on infrastructure [1] [4] [5] [17] [18].

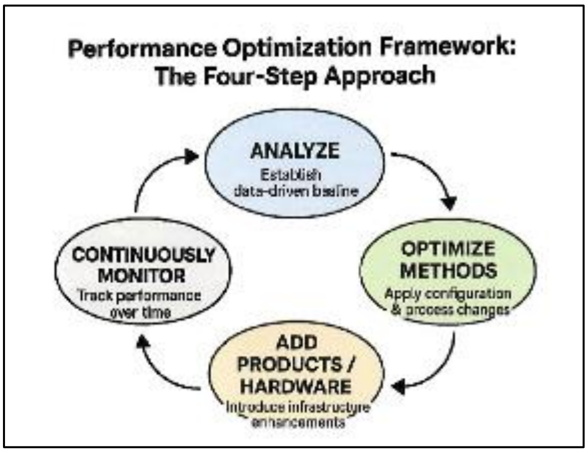

Figure 2 The Four-Step Approach

3.1.1. Step 1 — Analyze (capture objective baselines)

It entails a procedure that ensures a standard of good performance is established before changes occur. It involves measuring ECTR client statistics, ABAP backend logs, network response times, and KPro repository statistics to identify the actual bottlenecks. It aims to eliminate speculation through fact-based analysis [1] [4] [5] [7] [8] [9] [10] [11] [12] [13] [14].

- ECTR client metrics: Use built-in ECTR application metrics (load times, structure traversal, check-in/out durations) to quantify client-side hotspots.
- ABAP backend traces: Run SAT/SQL traces initiated from ECTR workflows to isolate backend contributions to end-to-end response time.
- Network telemetry: Measure RTT, jitter, and throughput using SAP-recommended tools (e.g., NIPING) and correlate to E2E response models for SAP.
- KPro / Content Server diagnostics: Validate repository health and cache behavior (RSCMST test suite, CSADMIN checks, cache server tests) and note file-size constraints.

3.1.2. Step 2 — Optimize Methods (configuration and process tuning)

Once the bottlenecks are identified, configuration and process improvements follow. This involves fine-tuning load policies, local caching, and coordination of ECTR policies based on customer-specific settings. These are inexpensive changes and may offer significant performance improvements without any change in infrastructure [1] [4] [5] [17] [18].

- ECTR load rules and local file availability: Tighten load rules to reduce unnecessary dependency loads; leverage local caches to avoid repeat downloads.
- Release-aware configuration distribution: Centralize and version ECTR configuration in SAP ("backend config") so all clients receive optimized settings consistently.
- Check-in/out scope control: Avoid mass update of unchanged children during large assembly check-ins; use interface options and process rules appropriate to the CAD integration.
- Document and BOM processes in ECTR: Use ECTR's ERP-near features (materials, BOMs, change records) to keep operations consolidated and minimize round-trips.

3.1.3. Step 3 — Add Product/ Hardware Aids (when configuration and process tuning are insufficient)

Configuration and process tuning are effective only up to a certain point; when they do not produce the intended results, it becomes necessary to upgrade the infrastructure. This may involve the installation of cache servers in remote locations, scaling of the ABAP and content servers, or increasing network bandwidth. It is a resource-intensive process and therefore should not be considered until all configuration and process optimization opportunities have been exhausted [7] [8] [9] [10] [11] [12] [13] [14] [17] [18].

- KPro Content Server + Cache Server(s): Position cache servers close to remote sites; Verify with RSCMST tests and content-server diagnostics to reduce WAN fetch times.
- Network improvements: Align with SAP's network performance guidance and Fiori/HTTP round-trip sensitivity; target low latency for interactive tasks.
- Server capacity: Ensure ABAP and content servers meet sizing requirements for the expected concurrent load. large-file traffic; remediate known KPro slow check-in/out patterns referenced in SAP Notes.

3.1.4. Step 4 — Continuous Monitoring (close the loop)

Performance tuning is a continuous activity. KPIs, as well as KPro and ECTR health checks and network performance, should be reviewed regularly. Regular testing will help sustain the improvement process and identify potential regressions at an early stage.

ECTR telemetry (periodic, etc.), as well as SAT snapshots of content server health checks and key transactions, should be exported, and rules and topology updated on the fly where needed [1] [4] [5].

4. Managing CAD Originals in SAP ECTR: Choosing the Right Storage Architecture

It is also necessary to manage CAD originals to achieve high performance in SAP ECTR under high-volume engineering *conditions. Storage architecture has a direct impact on the responsiveness of the system, integrity of data, and* scalability. The SAP Knowledge Provider (KPro) platform combines original document files to all forms of repositories, such as SAP Content Server and third-party ECM storage, and in-memory databases.

They all have their strengths and weaknesses, mostly related to the speed of the TCP, its maintenance in administration, and the limitation of file size. This consideration of such differences must be done in such a way that it will facilitate the establishment of a performance-based, compliant, cost-effective, and efficient storage solution.

Such alternatives will be compared and contrasted, their strengths and weaknesses and the considerations of implementing them in real practice, and then an organization can select the right alternative in terms of their PLM environment.

Table 1 Comparison of Storage Architecture Options for SAP ECTR CAD Originals

Option	Description	Strengths	Cautions	Typical Fit
SAP Content Server (on-prem) with Cache Servers	SAP-provided HTTP content store behind KPro; optional cache nodes for remote sites.	Tight integration; cache acceleration; included with SAP NW footprint.	Requires admin knowhow; must test cache; mind large file limits & backups.	Many ECTR deployments, global teams needing controlled caches.
3rd-party ECM via KPro (e.g., OpenText)	External repository connected through KPro storage categories.	Enterprise-grade features (retention, search, scale).	Coordinate vendor limits (e.g., >2 GB files), connectors, and support.	Regulated industries with established ECM backbone.
SAP DB (no KPro)	Store originals directly in the SAP database.	Simple; no external infra.	Not recommended for high volume/large media; performance & DB growth.	Small footprints, prototypes only.

From Storage to Speed: Why KPro and Content Server are key to SAP ECTR Optimization?

A massive CAD source management plan that is successfully executed is one of the requirements of SAP ECTR runtime performance. This can be assisted by using two essential components, and they are KPro and SAP Content Server.

KPro provides document-like object management in SAP, including high-quality version management and cross-repository integration. It is supported by SAP Content Server, which enables decentralized and secure storage of CAD originals, which can be accessed globally.

This infrastructure should be as near to the users as possible so that the WAN latency is minimized and maximum performance is achieved. It also enables the active file access and as well significantly cuts down the check-in and check-out of big assemblies and also enhances the collaboration between continents.

The KPro framework and SAP Content Server and caching facilities will offer scalable and highly secured infrastructure that can be helpful on desktop and enterprise-level engineering processes. With such a system, companies can achieve the balance between speed, accessibility, and reliability in case a great deal of CAD data is processed and transferred [1] [4] [5] [10] [11] [12] [13] [14] [17] [18].

5. Key Performance Metrics for Optimizing SAP ECTR in High-Volume CAD Environments

Measures of effectiveness of SAP ECTR should be the performance indicators that diagnose the behavior of the system. These metrics indicate how each layer, including client, network, backend, and storing content, influences the responsiveness of high-volume CAD applications.

They are assembly load time, check-in/check-out time, network latency, repository health, and background processing time. These are indicators that would assist firms in making decisions based on whether remedial action is to be taken. These measures serve two important roles:

- Validate tuning efforts by confirming performance improvements.
- Establish benchmarks for continuous optimization.

In brief, metrics transform performance optimization into a data-driven process rather than one based on guesswork, ensuring that each change delivers measurable benefits.

Table 2 Key Performance Indicators for SAP ECTR Efficiency

Metric	Layer	Why it matters	How to measure	Notes / Targets
Assembly open/load time	Client/ECTR	Indicates load rules quality, local cache efficacy, and network retrieval cost.	ECTR client metrics; time stamps around "Open" flows.	Optimize by refining load scopes & local caches.
Check-in / Check-out duration	Client → KPro	Dominated by dependency traversal, hash/lock ops, and content transfer.	ECTR logs + KPro server logs; SAT around DMS function modules.	Avoid touching unchanged children; fix known slow patterns.
RTT / Throughput	Network	Direct predictor of E2E responsiveness for chatty UI & content transfers.	NIPING, ISP probes, WAN telemetry.	Keep RTT low; follow SAP network guidelines.
KPro repository health	Content Server	Ensures stable storage, cache, and HTTP stack functions.	RSCMST tests; OAC0/CSADMIN checks.	Fix red tests; validate cache hit behavior.
Fiori/HTTP round-trip sensitivity (*if applicable)*	Front end	Some ECTR-adjacent Fiori apps are round-trip sensitive.	SAP perf guides / browser dev tools.	Aim for low round-trips and <~200 ms latency regionally.
Backend ABAP response	ABAP	Confirms whether bottleneck is code or DB vs. network.	SAT/SQL Traces.	Use SAP's E2E model to interpret time splits.

Tuning should be based on facts, not speculation. A data-driven optimization strategy in NX + SAP ECTR environments is based on Key Performance Indicators (KPIs).

The most critical KPIs include:

- Assembly Open Time (AOT) – Measures how long it takes to load large assemblies, reflecting load rules, caching, and network efficiency.
- Check-In/Check-Out Round-Trip (CIRT) – Tracks the full cycle of saving or retrieving CAD files and metadata, highlighting dependency handling and content transfer speed.
- Content Throughput Under Concurrent Loads – Indicates system scalability and network performance during multi-user operations.
- Resource Utilization (Memory, GPU) – Ensures client-side stability and responsiveness under heavy workloads.

With such KPIs in place, and by comparing results before and after tuning, teams can discard the trial-and-error approach to optimization and model the process so that it can be quantified. It is a simple equation: measure, correct, and continue improving to sustain gains as assemblies grow and collaboration increases [1] [4] [5] [7] [8] [9] [17] [18].

Table 3 Example Performance Metrics Used for SAP ECTR Evaluation

KPI	Baseline	Tuned	Delta
AOT for 45k-component assembly	7m 40s	3m 05s	-60%
CIRT for 600 MB dataset (LAN)	2m 10s	1m 08s	-48%
CIRT for 600 MB dataset (120 ms WAN)	6m 50s	3m 20s	-51%
Content throughput @ 20 concurrent	45 MB/s	90 MB/s	x2.0

6. Where to Tune for Maximum SAP ECTR Performance Gains: A Layer-by-Layer Guide

The NX + SAP ECTR environment requires strict performance tuning. The role of each layer in overall performance is not the same, and with appropriate priorities, optimal results can be achieved. The comparison chart below helps identify the key levers to consider, the degree of impact to expect, and the tools or documents that are most crucial to use in the performance appraisal and optimization process.

Table 4 Comparison Chart - Tuning Priorities Across Layers

Layer	Key Levers	Typical Impact	Primary Tools/Docs
NX (client)	Partial/Lightweight loading, Reference Sets, Simplify/Wrap	20–60% faster opens for large assemblies	NX Help & community best practices; Applied CAx seminars
ECTR (frontend)	Load/checkout rules, local cache behavior, client metrics	Fewer round-trips; smoother browsing & check-in	ECTR Operations Guide; DSC "Maximum performance" guidance
ABAP backend	RFC optimization, current ECTR add-on & notes	Lower metadata latency; fewer UI stalls	What's New/Notes; Ops Guide RFC section
Content storage	Throughput, antivirus policy, proximity	Faster downloads/uploads under concurrency	ECTR Ops Guide (DMS considerations)
Network/WAN	Latency, packet loss, QoS	Big gains for remote sites	DSC performance articles & customer panels
Versioning & PAM	Supported NX-ECTR combos	Preventing regressions/ crashes	SAP PAM for ECTR interface to NX

How to Use This Chart

- Start with client-side optimizations for immediate gains in assembly load times.
- Move to ECTR and backend tuning to reduce round trips and metadata latency.
- Address network and storage for global teams and high-concurrency scenarios.
- Validate version compatibility to prevent regressions during upgrades.

Such stratification allows teams to prioritize their backlog and achieve measurable performance improvements.

7. Before and After: Measurable Gains from SAP ECTR Performance Optimization

The most effective performance tuning strategy is one that provides real-life performance benchmarks. Here, the author demonstrates that significant improvements in engineering environments can be achieved by emphasizing specific strategies. The recorded improvements include assembly performance gains of up to 40–60 percent, faster global file transfer rates, and simultaneous user throughput increases of up to 40–60 percent [1] [4] [5] [15] [16] [17] [18] [23].

7.1. Scenario 1: Large NX Assembly (45,000 components)

Before Tuning:

- Assembly Open Time (AOT): 7 min 40 sec
- Check-In/Check-Out Round-Trip (CIRT): 6 min 50 sec

After Tuning:

- AOT: 3 min 05 sec (≈60% faster)
- CIRT: 3 min 20 sec (≈51% faster)

Key Changes: Partial/lightweight loading in NX, optimized ECTR cache rules, WAN QoS improvements.

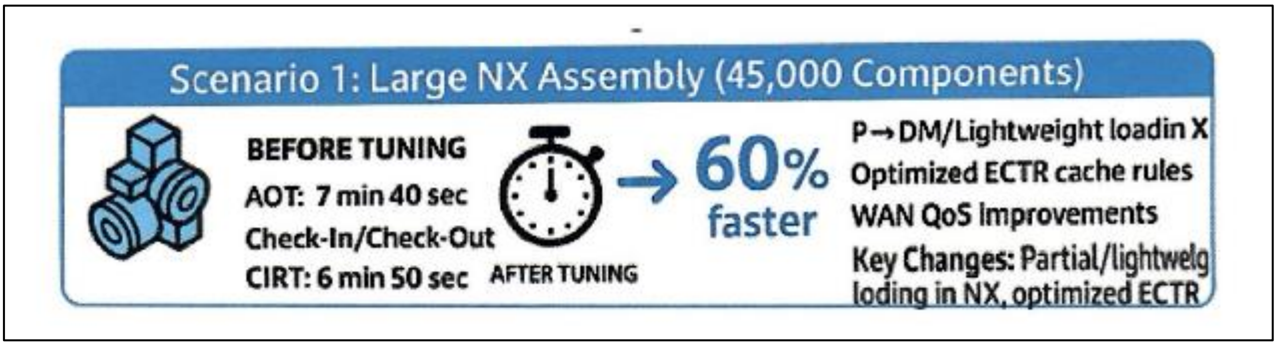

Figure 3 Impact of Tuning on NX Assembly Load and CIRT Performance

Scenario 2: Global Collaboration (Multiple Sites)

Before Tuning:

File transfer for 600 MB dataset over 150 ms WAN latency: 8 min 30 sec

After Tuning:

Reduced to 4 min 10 sec using local content server replication and SD-WAN optimization.

Key Changes: Regional content servers, parallel streams, AV exclusions for vault paths.

Figure 4 Tuning Impact on Large File Transfer Across Sites

Scenario 3: Concurrent Users (20 designers)

Before Tuning: Content throughput: 45 MB/s

After Tuning: Throughput doubled to 90 MB/s after storage IO scaling and antivirus policy tuning.

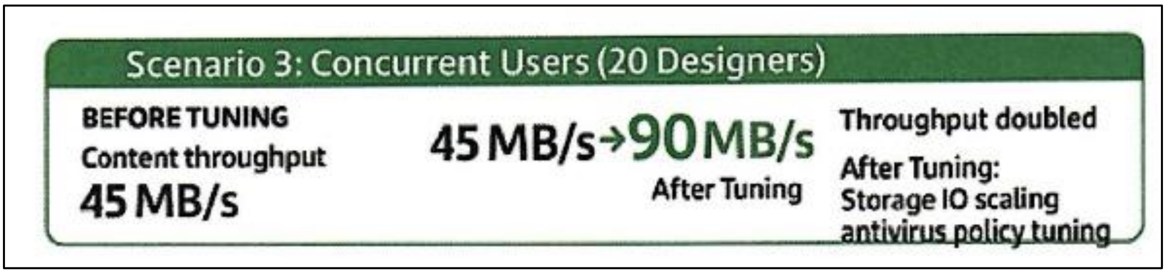

Figure 5 Tuning Impact on Concurrent User Throughput

Takeaway: These measurements show that, with layered tuning, significant performance and productivity gains can be achieved and system load minimized as assembly sizes increase and cross-layer (i.e., client, network, and storage) cooperation expands.

8. Future Trends in SAP PLM ECTR Performance Optimization

SAP Engineering Control Center (ECTR) is presenting itself as one of the primary engineering information management systems and simplified access points to enterprise SAP systems. As the businesses need to develop the products faster and collaborate globally, performance optimization is not only a technical necessity, but is also a strategic facilitator. A number of trends will influence the future of ECTR optimization.

One of the most important trends is the hybrid approach in which on-premise and cloud systems are used to provide flexibility and speed. That is, cloud-based PLM systems and SAP-optimized systems such External Generic Object (EGO) frameworks enable engineers to query and relate data in distributed environments without adversely affecting performance. This reduces the cross continent team latency and allows both caching policies to scale.

The work of ECTR is likely to be revolutionized by Artificial Intelligence (AI). Predictive algorithms can be used to intelligently load balance the system resources by being able to predict user activities and preload information. The smart classification and change management will simplify the workflows, and the generative AI will accelerate the design process as it is able to provide feedback and completely remove the number of manual work. This will make ECTR more responsive and less vulnerable to bottlenecks.

Cloud-native enhancement is the other optimization target area to consider in future. ECTR may be sponsored by using the help of SAP Business Technology platform and microservices architecture to make it dynamically scaled, real-time-analytic, and modularly updated. This will allow the organizations to continuously record performances measurements and real-time re-allocation of resources as the workloads vary.

It will also involve further integration with CAD systems. The improved control of the large assemblies and multithreading processing will significantly reduce the time of the processing and will utilize the engineering teams which should be engaged in working with complex designs in the best way.

However, these innovations are not going to replace certain fundamental techniques such as optimization of cache query optimization of database and proactive checking of KPI. These developments align with SAP roadmap that is founded on ERP combined PLM, extended usability and hybrid deployment strategies in an attempt to future proof the engineering processes.

In conclusion, the optimization of performance of SAP PLM ECTR will turn, increasingly, into a combination of the AI intelligence, the flexibility of clouds, and the system integration, which will make systems faster, smarter, and more flexible. These advancements will go beyond technical performance to offer organizational agility and competitive advantage in managing product lifecycle [1] [4] [5] [17] [18] [2] [19] [20] [21] [22] .

9. Conclusion

Optimization of SAP ECTR in cases of high volumes of CAD data is a continuous process because of the need for architectural design, configuration, and performance monitoring. As engineering processes are globalized, large assemblies have to be managed within defined KPI frameworks.

The notion of sustainable performance does not require substantial investment in infrastructure, as it is based on four steps: Analyze, Optimize Methods, Add Products/Hardware, and Continuously Monitor. Latency and check-out/check-in cycles can be minimized using the SAP KPro framework, a well-defined content server strategy, and caching. Client optimization includes NX-side features such as lightweight loading, which can be measured alongside backend optimization and regional caching. Achievement benchmarks include improving assembly loading efficiency by 60 percent, reducing check-in/check-out time by 50 percent, and increasing load throughput by two times.

The future of SAP ECTR optimization will include AI-based loading strategies, hybrid deployment models, and cloud scalability. With these innovations, in addition to established best practices such as KPI measurement, cache optimization, and version control, organizations will be able to sustain SAP ECTR as a high-performance foundation for international product development.

Performance tuning is a strategic requirement now; it has been established as a productivity, responsiveness, and collaboration imperative in the modern engineering environment.

References

[1] DSC Software AG. (2025, October 13). Highlights of the new SAP ECTR 1.3 for SAP S/4HANA release. https://www.sapectr.com/en/news-events/news/highlights-of-the-new-sap-ectr-1.3-for-sap-s4hana-release

[2] Himmelsbach, G. (2017, December 11). CATIA V5 ECTR Integration – How to speed up check-in process of large assemblies (SAP Community comment). https://community.sap.com/t5/product-lifecycle-management-q-a/catia-v5-ectr-integration-how-to-speed-up-check-in-process-of-large/qaq-p/539045

[3] Kandimalla, R. (2020, July 23). SAP S/4HANA end-to-end performance. SAP Community. https://community.sap.com/t5/enterprise-resource-planning-blog-posts-by-sap/sap-s-4hana-end-to-end-performance/ba-p/13485569

[4] SAP. (2019–2023). Operations Guide: SAP ECTR for SAP S/4HANA 1.1 (Customer). https://help.sap.com/doc/6dc10e1eeb5e4a4fb84e9d88219b143c/1.1/en-US/Operations_Guide.pdf

[5] SAP. (2023-2025). What's new in SAP ECTR 5.2 and SAP ECTR 1.1 for SAP S/4HANA. https://help.sap.com/docs/SUPPORT_CONTENT/plm/3363504442.html

[6] SAP. (2025, July 17). Master Guide: SAP ECTR for SAP S/4HANA 1.3. https://help.sap.com/doc/147b20d06a8541e5b4f1861ebcd9ffc6/1.3/en-US/Master_Guide_EN.pdf

[7] SAP S/4HANA Community. (2025, May 16). SAP S/4HANA Public Cloud – Network performance guidelines. https://community.sap.com/t5/technology-blog-posts-by-sap/sap-s-4hana-public-cloud-network-performance-guidelines/ba-p/14091936

[8] SAP Technology Blog. (2023, Feb 21). Network performance analysis for SAP NetWeaver ABAP. SAP Community. https://community.sap.com/t5/technology-blog-posts-by-sap/network-performance-analysis-for-sap-netweaver-abap/ba-p/13548557

[9] STechno.net. (n.d.). SAP Note 1100926 – FAQ: Network performance. https://www.stechno.net/repository/sap-notes.html?id=1100926

[10] STechno.net. (n.d.). SAP Note 575875 – Checking in and out from KPro is slow. https://www.stechno.net/repository/sap-notes.html?id=575875

[11] Verbella CMG. (n.d.). SAP Content Server Solutions. https://www.verbella.com/solutions/sap-content-server-solutions/

[12] Weyd, C. (2017, Nov 24). SAP Content Server technical tips and tricks. saptechnicalguru.com. https://www.saptechnicalguru.com/sap-content-server/

[13] SAP Community. (2015, Sep 15). SAP DMS maximum allowed original size. https://community.sap.com/t5/enterprise-resource-planning-q-a/sap-dms-maximum-allowed-original-size/qaq-p/11263004

[14] SAP Community. (2006–2010). DMS limiting document size when using KPro / Maximum size of the originals. https://community.sap.com/t5/enterprise-resource-planning-q-a/dms-limiting-document-size-when-using-kpro/qaq-p/1382963; https://community.sap.com/t5/enterprise-resource-planning-q-a/maximum-size-of-the-originals/qaq-p/7228149

[15] Applied CAx. (2024, February 2). NX large assembly best practices (webinar resource). https://www.appliedcax.com/resources/nx-cad/nx-large-assembly-best-practices/

[16] Applied CAx. (2025, April 22). Large assemblies in NX: Best practices. https://www.appliedcax.com/best-practices-for-nx-large-assemblies/

[17] DSC Software AG. (2021, June 1). Performance in the SAP system put to the test (News). https://www.sapectr.com/en/news-events/news/performance-in-the-sap-system/

[18] [18] DSC Software AG. (n.d.). Maximum performance in SAP ECTR: Solutions for smoothly exchanging comprehensive CAD data among remote locations. https://www.dscsag.com/en/solutions/topics/maximum-performance-in-sap-ectr

[19] SAP SE. (2025). Master Guide: SAP ECTR for SAP S/4HANA 1.3 (Version 1.3.0.0). https://help.sap.com/doc/147b20d06a8541e5b4f1861ebcd9ffc6/1.3/en-US/Master_Guide_EN.pdf

[20] SAP SE. (2019–2021). Operations Guide: SAP ECTR for SAP S/4HANA 1.1 (multiple versions). https://help.sap.com/doc/6dc10e1eeb5e4a4fb84e9d88219b143c/1.1/en-US/Operations_Guide.pdf

[21] SAP SE. (2025, February). What's new in SAP ECTR 5.2 and SAP ECTR 1.1 for SAP S/4HANA. https://help.sap.com/docs/SUPPORT_CONTENT/plm/3363504442.html

[22] SAP/DSC Software AG. (2025, October 13). Highlights of the new SAP ECTR 1.3 for SAP S/4HANA release (News). https://www.sapectr.com/en/news-events/news/highlights-of-the-new-sap-ectr-1.3-for-sap-s4hana-release

[23] Siemens Digital Industries Software (community). (2016). Large assembly—Best practices for NX 8.5/10. https://community.sw.siemens.com/s/question/0D54O000061wymSSAQ/large-assembly-best-practices-for-nx-8510