AI-Enhanced Intent-Driven BSS for Autonomous 6G Networks

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***Abstract*—The evolution toward 6G networks is driving a paradigm shift in telecommunications, characterized by increasing service diversity, dynamic customer demands, and the emergence of zero-touch operations. In this context, Business Support Systems (BSS) must evolve from manual, rule-based processes toward intelligent, intent-driven, and autonomous environments. This study explores the integration of Intent Management Function (IMF), Generative AI (GenAI), and multi-agent architectures to enable end-to-end automation of product offering, creation, sales, order capture and validation within BSS. Leveraging AI agents, enterprise requirements can be interpreted, structured into formalized orders, and executed seamlessly via Open APIs. Key solutions discussed include AI-powered guided selling agent, product configurator assistant, and cognitive loops comprising awareness, analysis, and proposal agents to optimize product lifecycle operations. The proposed architecture demonstrates improvements in operational efficiency, customer experience, and service agility like reducing the current new Product Offering creation time frame from weeks / days to within few minutes / hours. The findings highlight the potential of AI-enabled BSS to transform telecom operations, accelerate service provisioning, and realize the vision of intelligent, autonomous, and customer-centric 6G networks.**

***Index Terms*—Business IMF, Generative AI, Zero-Touch Operations, Product Offering Automation, SLA Negotiation, Cognitive Loops, Guided Selling, TMF Open APIs, 6G Networks, Autonomous Business Support Systems**

I. Introduction

As the telecom industry moves toward 6G, Business Support Systems (BSS) continue to encounter a major challenge because many essential workflows such as Product Offering (PO) creation, validation, ordering, and lifecycle management remain only partly automated or are still performed manually [1]. This limitation constrains operational agility at a time when product portfolios are expanding rapidly and customer expectations are shifting toward highly personalized, ondemand, and context-aware digital experiences. The increasing variety of products and the accelerated pace of product launches further underscore the need for BSS platforms capable of operating with greater intelligence, flexibility, and autonomy.

To address these challenges, the industry is increasingly adopting technologies that modernize and strengthen BSS capabilities. Intent-based operations, enabled by the Intent Management Function (IMF), allow high-level business objectives to be captured and systematically translated into technical workflows. This approach enhances alignment between BSS and Operational Support Systems (OSS) domains and simplifies the process of translating business requirements into executable network operations [2].

In parallel, AI-driven and agentic systems, supported by TM Forum's (TMF) ongoing work in Autonomous Networks (AN), GenAI in telecom [3], and AI in BSS [4] provide the foundations needed for advanced reasoning, autonomous decision-making, and coordinated multi-agent interactions across business processes.

Through continuous feedback loops, BSS processes can adapt and optimize in real time. When combined with intent-based operations, agentic AI, and cognitive automation, BSS evolves into an intelligent operational layer in emerging 6G networks, capable of interpreting business objectives, coordinating across multiple domains, and making context-aware decisions with minimal human intervention.

Within this technological landscape, our study introduces AI-enabled BSS solutions in the intelligent management layer of the Open Digital Architecture (ODA), which automate and optimize key business functions. The proposed framework demonstrates an end-to-end lifecycle encompassing PO creation, guided selling, order capture and validation, and cognitive-driven product instance replacement.

The main contributions of our solution framework are as follows:

- Introduction of a multi-agent architecture (Product Configuration Assistant) that automates PO creation and configuration using LLM-powered reasoning.
- Implementation of an intent-driven, conversational Guided Selling assistant that interprets customer requests in natural language, performs product qualification, and manages the end-to-end shopping cart process autonomously.
- Design of a continuous cognitive feedback loop with Awareness, Analysis, and Proposal Agents, enabling real-time adaptation to product and customer changes.
- Seamless integration with TMF APIs (e.g., TMFAPI-663, TMFAPI-679) to ensure compatibility with existing catalog and order management systems.
- Advancement of intent-based automation in BSS, enabling self-organizing, self-optimizing, and self-adapting operations that reduce manual effort and improve efficiency. An adaptation or optimization action which would have taken a BSS operational staff days to resolve if now automatically handled within few

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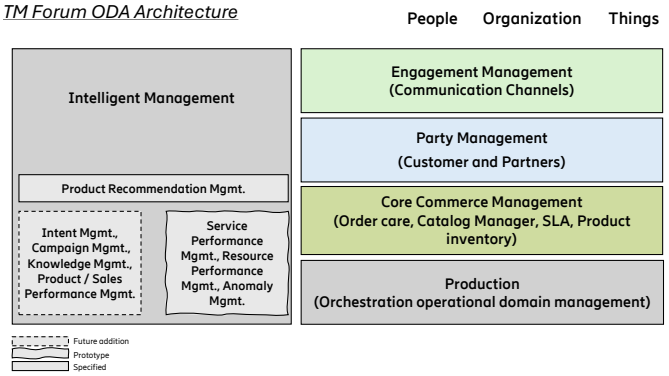


Fig. 1. TMF ODA and Multilayer Intent Based Architecture

minutes/ hours by the intent-based automation ensuring the customer and Communications Service Provider (CSP) business intents are always met.

The rest of this paper is organized as follows. The **Technical Background** section introduces ODA, its core components, and TMF processes for PO creation. Section **Literature Review** summarizes recent studies on AI-driven automation in BSS and intent-based operations. The **Proposed Solution Framework** section presents the AI-based architecture for PO creation, guided selling, product instance management, and cognitive replacement workflows. Finally, the **Conclusion and Future Work** section summarizes the key findings and outlines directions toward autonomous BSS systems.

II. Technical Backround

This section introduces the TMF ODA and the IMF, highlighting their roles in enabling intelligent BSS operations. It then focuses on key product-related BSS functions including catalog-driven PO creation for BSS core commerce, end-to-end PO capture and validation, and product instance management and replacement orchestration. These subsections describe how POs are modeled and published in ODA-aligned catalogs, how customer requests are captured and translated into orders, and how product instances are managed throughout their lifecycle. Finally, the proposed architecture is assessed using the TMF ANLET framework to provide an indicative evaluation of its automation and autonomy capabilities.

A. TMF ODA and IMF

The TMF ODA provides a modular, component-based framework designed to modernize BSS and OSS for telecom service providers [5]. By replacing traditional monolithic systems with standardized, reusable components and open APIs, ODA fosters flexibility, interoperability, and automation across the telecom ecosystem.

The ODA framework encompasses the entire network architecture including the BSS and OSS domains. It is structured into five principal layers, each serving distinct functional responsibilities within the overall architecture.

- Engagement Management layer: Directly interacts with enterprise and retail customers enabling product catalog browsing, quote generation, and product offer creation through TMF Open APIs such as Product Catalog, product offer, and Quote Management.
- Party and Customer Management layer: Ensures accurate customer identity, account, and preference of data linkage, which forms the basis for personalized POs.
- Core commerce Management layer: Translates product offers into commercial product orders, orchestrates order capture, validates, and decomposes into technical services via APIs. Catalog manager, order care, product inventory are the main components of the core commerce layer.
- Production and Resource Management layer: Handles order decomposition into service and resource orders, ensuring fulfillment and activation through intent-based orchestration and automated workflows.
- Intelligence Management layer: Provides analytics, AI-driven decision-making, and service level agreement (SLA) tracking to align product offers and orders with customer expectations, enabling closed-loop assurance by feeding operational insights back into product design.

The ODA architecture is still evolving, with several components and capabilities currently under active standardization. According to the ODA Component Inventory components are classified based on their maturity level, including specified, prototyped or future.

As illustrated in Figure 1, within the Intelligent Management layer, several capabilities related to autonomous decision-making and closed-loop automation are still identified as future areas of development. In particular, Intent Management is currently positioned in the ODA roadmap as a future capability within the Intelligent Management domain.

An intent is a declarative desired outcome from higher-level entities; within each domain, the IMF interprets and enforces these intents through closed-loop assurance for provisioning, optimization, and self-healing, and may issue subordinate intents to coordinate multi-domain objectives. The hierarchical intent-based management [6] such as Business IMF, E2E Service Management IMF and domain IMFs, organizes high-level service goals into domain-specific intents that are executed and reported upward step by step to ensure local actions stay aligned with overall network objectives and expectations.

The Business IMF operates within the BSS domain to manage the strategic objectives of a CSP. It translates high-level business goals, such as revenue growth, product performance, and customer satisfaction, into actionable intents for operational domains. The Business IMF aligns commercial strategies with dynamic operational conditions and communicates declarative requirements to OSS and other BSS components through intent-based interfaces.

The Business IMF interacts with Core Commerce components via TMF Open APIs, ensuring that service orders comply with business objectives and service-level targets before execution. The Intelligent Management Layer also incorporates additional advanced capabilities, notably

Generative AI and agent-based reasoning, closed loop, analytic solutions.

Motivated by this roadmap direction, this work explores the realization of intent-driven capabilities within the Intelligent Management layer. It investigates how intent-based mechanisms can support the product offer process and presents an initial proof-of-concept (PoC) aligned with ODA architectural principles, providing early insights into the evolution of Intent Management within the ODA Intelligent Management Layer.

B. Catalog-Driven PO Creation for BSS Core Commerce

CSPs must continuously evolve their product portfolios to meet dynamic market demands while maintaining order integrity and consistent customer experience. This requires a structured approach to PO creation within BSS core commerce, which is often manual or semi-automated, relying on business teams to define specifications and commercial rules for subsequent human review and catalog configuration. Advancing automation should focus on standardized workflows, API-driven catalog operations, and governance controls to ensure consistency and compliance.

PO creation represents a key intersection of product man agement, systems engineering, and operational governance. Guided by TMF standards [7], the process begins with defining a Product Specification, followed by the creation of one or more POs Each PO is configured in the catalog with pricing, eligibility, and bundling rules, and managed via the TMFAPI-620 Product Catalog Management API to automate creation, retrieval, and updates.

In practical implementations, TMF's use case TMFS012 [8] for launching a new PO prescribes a structured Business Requirement Document (BRD) workflow to capture and validate product information prior to catalog configuration. The BRD template functions as a standardized interface between business and technical teams, specifying product composition, pricing strategy, target customer segments, and lifecycle status. Currently, business teams author BRDs and technical staff perform reviews, validations, and catalog entries, leading to delays and potential inconsistencies.

To realize end-to-end efficiency and stronger governance, organizations should automate the transition from BRD approval to catalog instantiation by integrating BRD workflows with API-driven catalog management compliant with TMF (e.g. TMFAPI-620). Such automation would accelerate product launch cycles, enforce catalog consistency and compliance with enterprise governance, and reduce human error. Integrating these automated flows with AI assistants or configuration agents enables near zero-touch catalog management, supporting creation and configuration PO, publication as customer intents or market conditions change, as reflected in our proposed solution in Section IV-A.

C. End-to-End PO Capture and Validation

Following the definition of the PO, the next key phase in the BSS workflow is product order capture and validation within the Core Commerce domain. This process corresponds to the Configure–Price–Quote (CPQ) journey, where customer requirements are translated into executable product orders using standardized TMF APIs.

The workflow can be summarized in three main phases:

- *Phase 1* – Offer Discovery and Qualification. Customers browse and evaluate available product offers through digital channels or Customer Service Representatives (CSR). Product offers are defined and managed through the management of the TMFAPI-620 product catalog, while eligibility and feasibility are verified using the TMFAPI-679 Product Offer Qualification.
- *Phase 2* – Configuration and Quotation. Once an offer is selected, configuration and customization are performed using TMFAPI-760 Product Configuration Management and TMFAPI-663 Shopping Cart, ensuring that the selected offer aligns with the customer's requirements. Pricing and quotation are then generated via TMFAPI-648 Quote Management, completing the configuration stage of the CPQ process.
- *Phase 3* – Order Capture and Validation. After customer confirmation, the finalized configuration is submitted through TMFAPI-622 Product Ordering. The order is subsequently validated and decomposed into service-level requests using TMFAPI-641 Service Ordering, while product instance lifecycle and status are monitored via TMFAPI-637 Product Inventory.

While this workflow provides a structured and standardized approach to order capture and validation, several manual interventions still remain, particularly in customer interaction, configuration refinement, and eligibility verification. To support the evolution toward intent-based operations, TMF has introduced intent-related capabilities within its architecture, including the TMFAPI-921 Intent Lifecycle Management API. However, these capabilities are currently defined primarily as emerging architectural components, and their integration into operational product order workflows is still under development.

When combined with AI-powered CPQ assistants and generative agents, these emerging intent mechanisms can enable CSPs to evolve the traditional order capture process into a more dynamic and adaptive model. In such a model, catalog updates, guided selling, and offer personalization can be automatically driven by contextual information such as customer preferences, service usage patterns, and market conditions, moving the CPQ process closer to intent-driven service orchestration, as reflected in our solution presented in Section IV-B.

D. Product Instance Management and Replacement Orchestration

After capturing the product order, managing the corresponding product instances is a crucial step to ensure proper service lifecycle tracking, operational consistency, and alignment with customer requirements. Product instance management covers monitoring, updating, and maintaining deployed instances throughout their lifecycle, including activation, modification, replacement, and decommissioning.

A particularly critical scenario is the replacement of existing product instances with new ones which enables upgrade, modification, or swap of services seamlessly without service disruption for the customer. This process typically involves identifying the instances to be replaced, preparing the new product instances, orchestrating the handover, and validating the updated services to ensure continuity. In the TMF framework, standard APIs such as TMFAPI-622, TMFAPI-663, and TMFAPI-637 provide structured mechanisms to support these operations. TMFAPI-622 allows BSS to track and update product instance records accurately, TMFAPI-663 enables automated orchestration of the replacement orders, and TMFAPI-637 ensures that catalog information is synchronized so that new POs are correctly aligned with customer entitlements and service definitions.

In advanced orchestration environments, these processes can be largely automated, reducing manual effort, errors, and service disruptions. In contrast, manual workflows rely on human coordination and spreadsheets, increasing operational risks and delays. The combination of TMF APIs, orchestration, and closed-loop validation enables automation aligned with the BSS domain.

Integrating AI-driven agents and cognitive feedback loops within IMF further improves efficiency by identifying instances requiring replacement, scheduling updates, and validating newly deployed instances against service and SLA requirements. Section IV-C demonstrates this capability in the proposed solution. Cognitive feedback loops allow the system to adapt to changes in customer demands, product availability, or network conditions, supporting automated product lifecycle management and advancing zero-touch service operations aligned with the ODA vision.

E. TMF ANLET Assessment

The TMF ANLET framework provides a conceptual model for understanding the evolution of intelligence and automation in telecom operational systems [9]. ANLET structures operational processes into five cognitive stages: Intent, Awareness, Analysis, Decision, and Execution, representing the transformation of high-level service objectives into concrete operational actions. The Intent stage captures business or service goals, while Awareness collects contextual information about network conditions, services, and users. In the Analysis stage, this information is interpreted to identify possible operational alternatives. The Decision stage determines the most appropriate action based on policies, constraints, and objectives, and the Execution stage implements the selected action within operational systems.

To complement these cognitive stages, TMF also defines Autonomous Network Levels (ANL), which classify the degree of operational autonomy within telecom environments. These levels range from ANL-0, where operations are fully manual and rely entirely on human operators, to ANL-5, which represents fully autonomous networks capable of self-managing operations with minimal or no human intervention. Intermediate levels describe increasing degrees of automation and system intelligence, including assisted operations (ANL-1), partial automation (ANL-2), conditional autonomy (ANL-3), and highly autonomous operation (ANL-4), where closed-loop control enables systems to automatically monitor, analyze, decide, and execute actions under limited human supervision.

Together, the ANLET cognitive stages and the ANL maturity levels provide a structured framework for analyzing how telecom operational workflows evolve from manual processes toward highly autonomous and self-managing network systems.

In this work, the ANLET framework and ANL maturity levels are adopted as an evaluation model to analyze assess the level of automation and intelligence in the proposed workflow.

III. Literature Review

In recent years, intent-based networking has emerged as a foundational paradigm for autonomous network management, enabling operators to express high-level goals without prescribing implementation details. Early comprehensive studies in the literature, formalized the shift from configuration-centric to intent-centric operations, emphasizing the translation, assurance, and lifecycle management of intents across network domains [10]. Building on this foundation, research introduced multi-layer intent architectures in which business, service, and resource domains collaborate through hierarchical IMFs [6].

As architectures evolved, multi-layer orchestration frameworks were proposed to translate business-level objectives into technical workflows. AI-driven intent-based architectures further introduced decision-making and predictive capabilities to manage SLA objectives and optimize resource utilization [11]. Domain-specific studies, such as Healthcare 4.0, demonstrated the feasibility of hierarchical intent fulfillment with continuous monitoring for latency-sensitive and secure services [12].

BSS-level automation has recently attracted attention as CSPs aim to extend autonomy to product catalog management, order capture, validation, and SLA lifecycle processes. Ericsson demonstrated that multi-agent AI can transform OSS/BSS by enabling proactive decision-making, catalog-driven configuration, and dynamic resource-aware product assembly [13]. These works highlight the potential of integrating BSS Core Commerce modules (catalog, order care, charging) with autonomous orchestration through TMF Open APIs. Yet, most implementations rely on static rule-based automation, limiting flexibility in customer negotiations and product personalization.

To address these limitations, recent AI-enabled and agent-based intent frameworks have primarily focused on refining intent translation, conflict mitigation, and ensuring consistent assurance across network service and operation domains. For example, [11] demonstrates how AI-driven conflict detection, feasibility validation, and distributed assurance can enhance the execution of service-layer intents. Even though the intent-based methods can capture objectives related to attributes such as latency or reliability, existing frameworks do not incorporate these capabilities into

catalog-driven product structures, PO creation, or order capture workflows.

The emergence of Generative AI and LLMs enables natural language intent extraction and structured order generation. Recent studies show that LLMs can interpret user intent in 5G environments and translate it into machine-readable service specifications [14]. Industry trends highlight agentic AI, where collaborative agents reason and act on business objectives to support adaptive product ordering and cross-domain negotiation [15]. However, existing work does not yet unify GenAI-based intent interpretation, multi-agent collaboration, and BSS-level product ordering with SLA negotiation within a single framework.

Therefore, existing research establishes strong foundations in intent-based autonomy and AI-driven orchestration but stops short of applying these principles to the BSS. A gap remains in demonstrating how GenAI-powered AI agents can capture enterprise requirements, structure product orders, negotiate SLA terms, and seamlessly interact with Core Commerce systems via TMF standards. The proposed work addresses this gap by operationalizing intent-driven automation in BSS, enabling autonomous product ordering.

IV. Proposed Solution Framework

Up to this point, the state-of-the-art processes for a CSP have been presented, covering the lifecycle of a service as a product from catalog introduction to commercialization and replacement. These processes form a continuous cycle of PO creation, sale, and replacement within CSP business operations.

The solutions and methodologies proposed in this section describe how AI-driven frameworks and intent-based architectures enhance automation, governance, and operational efficiency across these stages. To improve readability and clarify the relationship between existing approaches and the proposed solutions, Table I provides a consolidated overview.

A. GenAI-Powered Product Configuration Framework

The proposed Gen-AI powered Product Configuration Assistant (PCA) operates as an intelligent co-pilot that supports Product Managers and Business Configuration Engineers throughout the end-to-end PO creation and configuration lifecycle. As illustrated in the PCA framework in Figure 2, the interaction begins when a Product Manager initiates a new PO request through the PCA Client, using text. The textual request is then handled by the Chat Model, which acts as the cognitive engine of the PCA. Based on the user's intent and conversational context maintained by the Chat Content Service, the Chat Model coordinates the appropriate specialized AI agents within the PCA.

In the first stage, the BRD Agent interacts with the Product Manager to generate a structured BRD using a predefined template. This interaction captures key PO attributes such as target customer segment, product composition, service bundles, pricing logic, and business constraints. During this step, the BRD Agent may also retrieve supporting information from the PCA Database, where product documentation

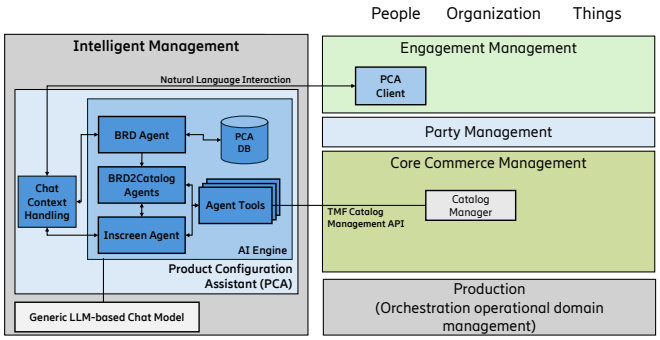


Fig. 2. Gen AI based Product Configuration Assistant Framework.

embeddings and prior BRD artifacts are stored, enabling retrieval-augmented generation (RAG) for context-aware assistance.

Once the BRD is completed and approved, the workflow proceeds to the second stage, where the BRD2Catalog Agent transforms the validated BRD into catalog-ready entities. This agent interprets the approved business requirements and maps them into technical catalog objects, relationships, and configuration parameters required for implementation. To perform this task, the BRD2Catalog Agent uses Agent Tools that provide access to BRD retrieval services, documentation queries, and standard Catalog Management APIs.

For cases requiring detailed catalog refinement, Business Configuration Engineers can interact with the InScreen Agent, which provides an interactive workspace for reviewing documentation, querying catalog structures, and adjusting configuration details. This enables human-in-the-loop validation where needed, while still preserving the efficiency of AI-assisted automation. Finally, the generated catalog entities are submitted to the target Catalog environment, which acts as the system of record for all configured product offers and related components. In this way, the PCA enables a seamless flow from business intent capture to technical catalog realization, reducing manual effort, improving consistency, and accelerating PO onboarding.

This PoC demonstrates that Product Offering (PO) creation within the CSP product lifecycle can be automated using AI-based agents and TMF Open APIs. By enabling dynamic product interpretation and guided configuration, multi-agent systems reduce manual effort and errors while accelerating product launches and improving governance. From an ANLET perspective, the proposed PCA framework corresponds approximately to ANL-3, as intent interpretation, contextual awareness, and configuration analysis are supported through LLM-assisted reasoning, while execution is realized through automated, tool-driven TMF API interactions within governed catalog management workflows.

B. AI Driven Guided Selling Assistance

The Guided selling assistant, acting as a virtual sales assistant, provides contextualized and personalized guidance

TABLE I
MAPPING OF STATE-OF-THE-ART TO OUR PROPOSED SOLUTIONS.

State of Art	Gap/Limitation	Proposed Solution	Contribution	ANLET Progression
Catalog-Driven PO Creation for BSS Core Commerce	Manual or semi-automated processes cause delays, inconsistencies, and human errors in PO creation. Integration between BRD approval and catalog instantiation is weak, limiting end-to-end automation and governance. *(Section II-B.)*	**Product Configuration Assistant**	Reduces manual intervention and errors, accelerates product launch cycles, enforces catalog consistency and governance, and enables adaptive, near-zero-touch product configuration using AI-driven multi-agent collaboration. Supports scalability, maintainability, and flexibility for evolving business requirements. *(Section IV-A.)*	ANL-2 → **ANL-3**
End-to-End PO Capture and Validation	Manual interventions remain in customer interaction, configuration refinement, eligibility checks, and offer personalization. Integration of intent-driven operations is limited, slowing adaptation to dynamic customer requirements and market context. *(Section II-C.)*	**AI-Driven Guided Selling Assistance**	Reduces manual intervention, accelerates order capture, enhances personalized product recommendations, ensures accurate and dynamic offer qualification, and enables near real-time intent-driven CPQ processes. Supports adaptive, scalable, and automated BSS operations for enterprise customers. *(Section IV-B.)*	ANL-2 → **ANL-3**
Product Instance Management and Replacement Orchestration	Manual workflows and limited automation create delays, errors, and service inconsistencies in product instance updates and replacements. Existing systems often lack proactive, real-time intelligence to identify optimal replacement candidates and execute changes with minimal human oversight. *(Section II-D.)*	**Zero-touch Product Instance Management and Replacement Orchestration Framework**	Enables adaptive, zero-touch product instance management and replacement orchestration, reducing human intervention, minimizing service disruption, optimizing resource utilization, and supporting self-optimizing BSS operations aligned with TMF ODA vision. *(Section IV-C.)*	ANL-1/2 → **ANL-4**

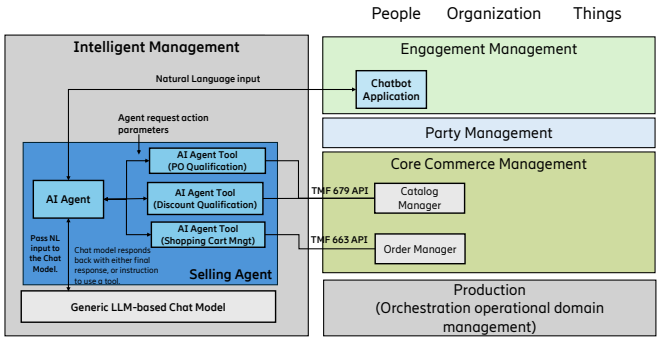


Fig. 3. AI-Driven Guided Selling Assistance Framework.

for the overall sales process while allowing the customer to interact with it in natural language. The Business IMF orchestrates intelligent decision-making across BSS operations by coordinating AI agents and cognitive loops. Within this framework, the Selling Agent is implemented as a functional component of the Business IMF, enabling the guided selling capability to operate as an intent-driven interaction layer between enterprise customers and underlying BSS systems. Guided Selling serves as the front-end application of intent-driven automation, allowing enterprise customers to express requirements in natural language, receive optimized product recommendations through AI-assisted reasoning, and translate these requirements into Business IMF intents. in Figure 3, illustrates the major components of this Guided Selling architecture and their interactions.

The PO Qualification Tool uses the PO category and the existing Shopping Cart ID to prepare and invoke the PO Qualification API (TMFAPI-679) toward the Catalog Manager. The Shopping Cart Management Tool takes the Shopping Cart ID along with a list of products, product characteristics, or optional products to be added, updated, or removed, and invokes the Shopping Cart API (TMFAPI-663) toward the Order Manager. Finally, the Discount Qualification Tool leverages the PO category for discount POs and the existing Shopping Cart ID to prepare and invoke the TMFAPI-679 toward the Catalog Manager, exclusively identifying applicable discount offerings.

The process begins with a B2B customer request submitted in natural language via a chatbot application, which is then processed by an AI agent leveraging an LLM. The AI agent is integrated with tools capable of invoking APIs in applications such as Catalog Manager and Order Manager to retrieve information or perform actions. Based on customer prompt, the LLM determines the appropriate tool and its required arguments, which the AI agent subsequently executes. This framework enables the AI agent to utilize specialized tools for targeted interaction with BSS systems and precise API operations.

The presented PoC introduces an intelligent enterprise chatbot to support requirement definition, product configuration, and quote generation while reducing manual intervention and improving personalized recommendations. By enabling accurate offer qualification and ODA–aligned Open API integration through the Business IMF, the approach prepares existing BSS environments for intent-driven interactions. According to the ANLET framework, the proposed AI-driven guided selling architecture corresponds approximately to ANL-3, as it automates intent interpretation, maintains awareness through catalog and eligibility retrieval, performs analysis and decision through agentic reasoning, and

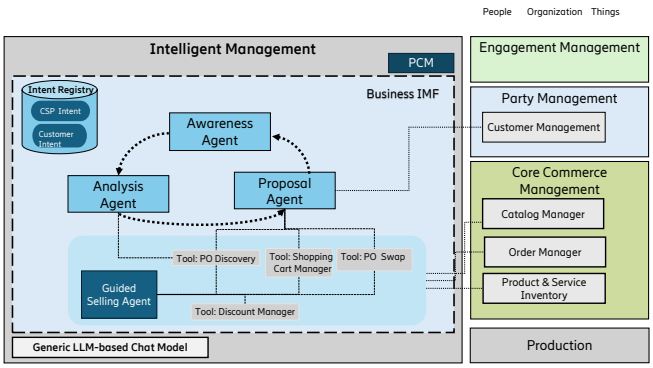


Fig. 4. Cognitive loop of Awareness, Analysis, and Proposal agents within the Business IMF.

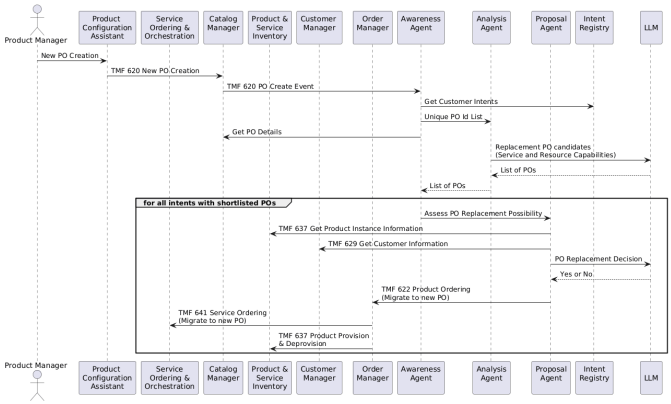


Fig. 5. Product Offering Replacement and Migration Flow

executes the workflow via automated TMF API interactions within the CPQ process.

C. Zero-touch Product Instance Management and Replacement Orchestration Framework

The Business IMF mentioned in the previous section has multiple tasks. This section illustrates how it incorporates a cognitive loop that continuously monitors system events, analyzes their impact, and proposes optimized actions to enable adaptive and autonomous business operations. By bridging business-level awareness with data-driven decision-making, this mechanism allows the BSS to dynamically adapt to product, customer, and market changes. As illustrated in in Figure 4, the cognitive loop within the Business IMF captures product-instance-replacement events and executes the corresponding decision process through three AI agents (Awareness, Analysis, and Proposal) each responsible for a specific stage of autonomous business optimization.

Awareness Agent is responsible for receiving inputs from external systems such as notification events received when a new business entity like PO or Service is activated. Based on the information contained in these events it may do some preliminary processing and trigger the Analysis Agent.

Analysis Agent carries out a more detailed analysis to identify what impact the new event may have on the installed base. For Example, if a new PO is activated does it provide significant improvement in services provided by existing POs targeting the same domain or vertical.

After that Proposal Agent proposes action(s) that maybe performed to improve the Customer or Operator's business intent that is already available in the system. In order to take this decision, the Proposal Agent uses the information related to Customer and it's provisioned products and services.

To further illustrate how the cognitive loop is operationalized within the BSS environment, Figure 5 presents the detailed interaction workflow for product instance replacement and migration across AI agents and BSS components. When a new PO is created in the Commercial Catalog, a TMFAPI-620 Product Offering Create event triggers the Awareness Agent. The Awareness Agent identifies customer intents associated with offerings in the same category and forwards the relevant PO identifiers to the Analysis Agent.

The Analysis Agent evaluates potential replacement candidates using LLM-assisted reasoning over service and resource characteristics. For each shortlisted offering, the Proposal Agent retrieves customer and product instance information via TMFAPI-637 and determines whether the existing PO should be replaced. If the replacement is approved, a new product order is generated through TMFAPI-622 to migrate the existing offering to the newly introduced PO.

This PoC implements a Business IMF cognitive loop composed of Awareness, Analysis, and Proposal Agents to autonomously process product-instance replacement events and recommend optimized actions. By identifying suitable replacement candidates in real time and reducing manual intervention, the mechanism supports zero-touch product instance management and advances BSS operations toward ODA-aligned automation. According to the ANLET model, the proposed workflow corresponds approximately to ANL-4, as it enables automated reasoning across awareness, analysis, decision, and execution stages through event monitoring, LLM-assisted evaluation, policy-driven decision making, and automated order orchestration.

V. Conclusion and Future Scope

This paper examines the state-of-the-art of product-related processes in BSS operations, highlighting the role of ODA and associated APIs in enabling automation. It identifies key automation requirements for advancing toward zero-touch, intent-driven networks and shows how AI agents and cognitive loops can address gaps in current BSS architectures by reducing manual intervention, improving decision-making, and enabling adaptive operations.

The proposed AI- and agent-based BSS framework integrates multi-agent systems, Generative AI, and the Business IMF to automate core processes such as PO creation, guided selling, order capture, validation, and product instance management. Cognitive-loop agents supporting awareness, analysis, and proposal functions enable dynamic product replacement and real-time decision-making. Sales agents

within the Business IMF translate enterprise requirements into operational intents, while TMF Open APIs ensure modularity, interoperability, and compliance with existing standards. The proposed PoC builds on TMF standards and does not require additional standardization.

Overall, the framework demonstrates how intelligent and standardized AI-driven mechanisms can transform BSS operations, providing a practical pathway toward scalable, autonomous, and zero-touch enterprise services. The proposed solutions build upon existing TMF standards and do not require additional standardization. The ANLET-based evaluation presented in this work provides an indicative assessment of the proposed architecture. However, due to the current lack of well-defined evaluation scenarios, standardized criteria, and comprehensive assessment tables within the ANLET framework, the evaluation should be considered preliminary rather than fully scientific.

Future work will extend cognitive and autonomous capabilities across the product lifecycle, enabling dynamic recommendations, automated bundling, predictive analytics, and multi-agent negotiation. Integration with network and resource monitoring can further support feasible configurations and continuous learning, advancing toward fully autonomous and adaptive BSS operations for next-generation networks. As the ANLET framework continues to mature, more robust and fact-based evaluations of autonomous BSS workflows will become possible.

ACKNOWLEDGMENT

This work was funded by The Scientific and Technological Research Council of Turkey (TUBITAK), under the 1515 Frontier R&D Laboratories Support Program with project no:5169902.

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