

CELFOCUS



Increasing Autonomy for Networks

Table of Contents

01	The Autonomy Gap Moving Beyond Domain-Specific Autonomy	p.3
02	Our Approach Harmonised Multi-Domain Autonomy	p.8
03	Making it Real Proven Value in Industrialised Autonomy	p.12
04	Five Pillars for Success Scaling from Single to Multi-Domain Networks	p.16
05	Where to Start The Path to Multi-Domain Scale	p.19
06	Why Celfocus Proven Track Record in Telco AI	p.21



01

The Autonomy Gap

Overcoming Multi-Domain Silos



The Autonomy Gap

Overcoming Multi-Domain Silos

The industry is undergoing a profound transformation toward AI-native networks, yet legacy operational models remain a core bottleneck. While successfully industrialise domain-specific autonomy is a positive step, scaling this success across the entire network requires bridging the “Autonomy Gap” created by fragmented data and siloed operations.

Three Core Bottlenecks



Structural Silos

Network domains managed by dedicated teams with domain-specific tools create critical blind spots in end-to-end visibility.



Operational complexity

Long response times, and service disruption.



Reactive Network Operations

Teams still firefight issues instead of proactively anticipating and preventing problems.

“Our idea was that somebody collects all the data in real time and tells us what happened. None have been able to do so.”

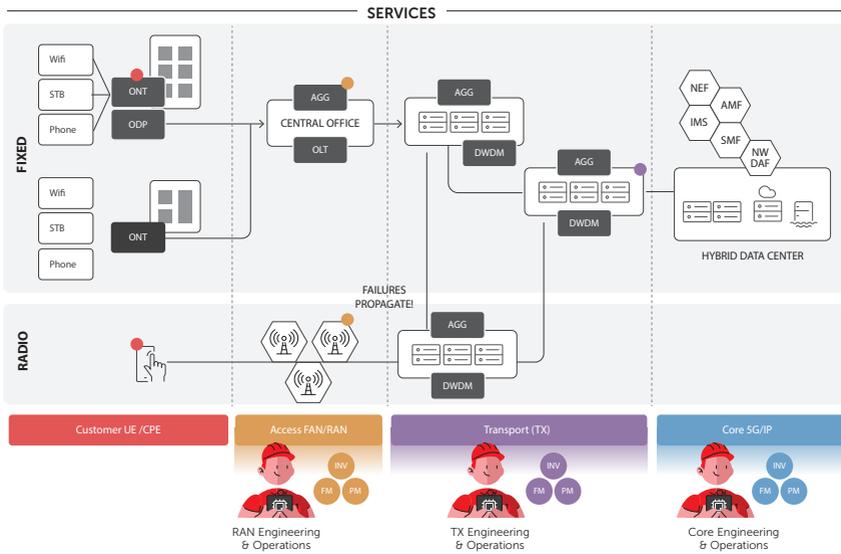
CSP Tier 1 - Technology Leader

Today's Challenge

Siloed Network Domains

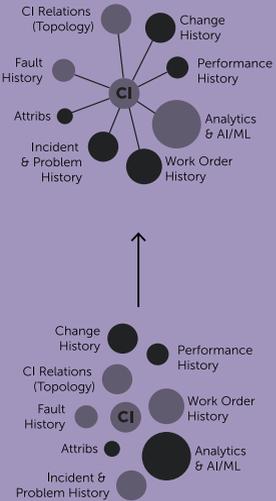
Network domains operate in silos with specialised teams and tools, which yields deep expertise but fragmented visibility and poor cross-domain context. This makes it difficult to correlate events quickly and understand overall impact.

A single fault can cascade across domains, creating multiple alarms that are treated as separate incidents by NOCs. The result is duplicated work, longer resolution times and higher costs—requiring unified observability and cross-domain correlation to find the true root cause.



NETWORK DIGITAL TWINS

From voluminous & sparse operational data to Actionable Insights + Agentic AI enablement



USE CASES

<h3>Smart CAPEX RAN + Core</h3> <p>Use vendor energy-saving features, smart capacity shutdowns, and tariff/battery-aware scheduling to cut active resources by traffic and time while keeping coverage, QoS, and lowering energy costs.</p> <p>Engineering</p>	<h3>Multi-Domain Operations RAN + TX + MW</h3> <p>Combine events from multiple domains to perform anomaly detection, perform root cause analysis and provide recommendations to engineers</p> <p>Operations</p>	<h3>Impact Assessments TX + IPBB</h3> <p>Ability to infer service and customer impacts from planned interventions or incidents occurring in a given network node.</p> <p>Operations</p>	<h3>Multi-Layer Operations 4G/5G Core</h3> <p>Combine Physical, Virtual & application layers to apply anomaly detection, RCA and recommendation engines.</p> <p>Operations</p>	<h3>Agentic Service Performance RAN + Core</h3> <p>Use Agentic Analytics on raw RAN and Core metrics to generate dynamic service performance reports.</p> <p>Operations</p>
---	--	--	---	--

-99% Root Cause Analysis effort

-95% Impact Assessment effort

-30% Tools & licensing effort

WHY CELFOCUS



Synergistic teams combining business, data, and AI expertise for B/OSS and networks



Proven track record with 5 of the top 6 European CSPs



Ready assets to accelerate delivery functions & algorithms, data models & ontologies, and data collection & transformation

Lean Approach & Delivery Principles



Continuous Development



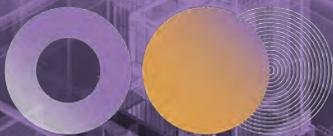
Continuous Collaboration



Continuous Delivery

LEAN APPROACH

<p>PILOT</p> <p>I: Offline Pilot Understanding context and show value with an offline pilot that can be evolved towards final solution</p> <p>BENEFITS Selecting lean set of features and integrating data offline to prove value</p> <p>9 WEEKS (ESTIMATED)</p>	<p>MVP LIVE</p> <p>II: MVP Implementation Evolve pilot foundations towards final solution and connect real time data streams while implementing additional use cases</p> <p>BENEFITS Operational value delivery, integrating data pipelines with OSS & Network data sources</p> <p>3-4 MONTHS (ESTIMATED WITH GATED DELIVERIES)</p>	<p>III: Evolution Iterations Evolve solution delivering continuous benefits according to business priorities</p> <p>BENEFITS Use cases according to business priorities and goals</p> <p>CONTINUOUS EVOLUTION</p>
--	---	--



02

Our Approach

Harmonised Multi-Domain Autonomy



Target State

Unified Multi-Domain Visibility

Operations teams need an end-to-end, real-time view across all network domains to track incident propagation and enable automated resolution.

Unified multi-domain visibility also supports strategic planning and smarter CAPEX: using predictive analytics and what-if modeling, CSPs can assess investment impact, anticipate bottlenecks, optimise resource allocation, mitigate risks, and prioritise spending for long-term readiness and growth

Network Digital Twin

Building Strong Foundations

Network digital twins are near-real-time virtual replicas of network ecosystems that break data silos and enable simulation, prediction and optimisation.

Implementing a robust digital twin involves adopting a hybrid federated data ecosystem to balance cost, performance and governance.

DATA LAKES

Store large unstructured data for broad analytics.

GRAPHS DATABASES

Model complex relationships with graph algorithms.

TIME-SERIES DATA

Track trends with recurring metrics over time.

TABULAR DATASETS

Organise structured data in tables for easy access.

VECTORISATION

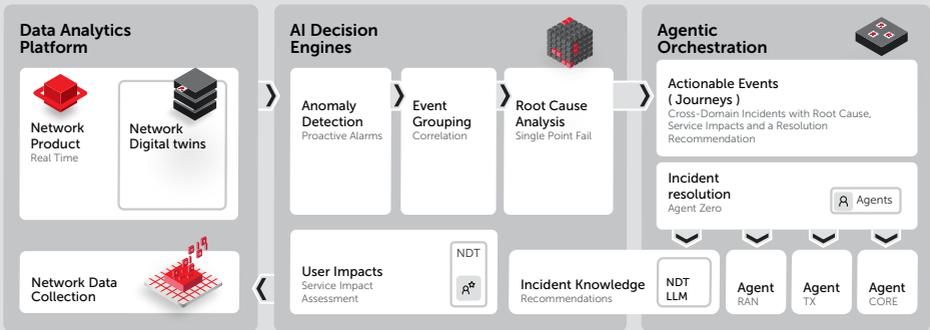
Use embeddings for fast AI-driven similarity and contextual searches and analysis.

The Solution

Targeting Multi-Domain Autonomy

Our open and vendor-agnostic assurance solution framework is composed of modular and decoupled layers instantiated independently.

The Three-Pillar Framework



Data Analytics Platform
real-time visibility of the network

AI Decision Engine
agentic system for RCA and recommendations

Agentic Orchestration
autonomous coordination across multi-domains



03

Making it Real

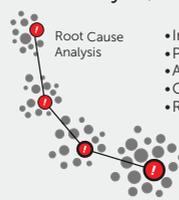
Proven Value in Industrialised Autonomy



Making it Real Proven Value in Industrialised Autonomy

The implementation of a Network Digital Twin (NDT) shifts operations from reactive, fragmented processes to **intelligent, data-driven autonomy**. By providing the essential “dependency truth,” Celfocus empowers CSPs to achieve **guardrailed autonomy**—where AI agents act safely and decisively based on a reconciled knowledge layer.

Below are the measurable breakthroughs we have achieved across high-value operational domains:

<p>Smart CAPEX RAN + Core</p> <p>REFERENCES</p> <p>Czech Tier 1 ONGOING ●</p>	<p>Use vendor energy-saving features, smart capacity shutdowns, and tariff/ battery-aware scheduling to cut active resources by traffic and time while keeping coverage, QoS, and lowering energy costs.</p> 
<p>Multi-Domain Operations RAN + TX + MW</p> <p>REFERENCES</p> <p>UK Tier 1 LIVE ●</p> <p>France Tier 1 ONGOING ●</p>	<p>Unified view across physical, virtual, and application layers to support anomaly detection, root cause analysis, and actionable recommendations.</p> <p>Root Cause Analysis</p> <ul style="list-style-type: none">• Inter and Intra domain network fault correlation• Proactive real-time anomaly detection on metrics• Automated Root Cause & Service Impacts• Correlation with change management occurrences• Recommendations for next steps 
<p>Agentic Service Performance RAN + Core</p> <p>REFERENCES</p> <p>Belgium Tier 1 ONGOING ●</p>	<p>Use Agentic Analytics on raw RAN and Core metrics to generate dynamic service performance reports.</p> 

Impact Assessments TX + IPBB

REFERENCES

Belgium Tier 1	LIVE •
Italy Tier 1	ONGOING •
UK Tier 1	ONGOING •

Tracing dependencies through the transport and IP backbone to slash impact analysis time from days to hours, leading to 60% fewer escalations to technical teams.

From multiple days to a couple of hours

Calculating service impacts on TX/IP networks upon planned interventions

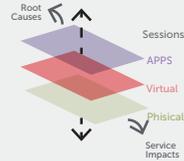


Multi-Layer Operations 4G/5G Core

REFERENCES

Belgium Tier 1	LIVE •
UK Tier 1	ONGOING •
Spanish Tier 1	ONGOING •

Combine events from multiple domains to perform anomaly detection, perform root cause analysis and provide recommendations to engineers



- Multi-layer network data correlation across physical, virtual, and application domains
- Real-time anomaly detection with proactive alerting
- Adaptive and dynamic thresholding based on network behavior
- Automated root cause analysis and service impact assessment
- Actionable recommendations to guide next steps and remediation
- Agent-based resolution workflows to accelerate incident handling

-99%

Root Cause Analysis effort

-30%

Tools & licensing effort

-95%

Impact Assessment effort



04

Five Pillars for Success

Scaling from Single
to Multi-Domain
Networks



Five Pillars for Success

Scaling from Single to Multi-Domain Networks

1 - COLLECTION & INTEGRATION FRAMEWORK

Create a real-time, extensible integration layer (plugins/connectors) to handle multi-vendor, multi-protocol and multi-format data flows.

2 - VENDOR-AGNOSTIC DIGITAL TWIN

Deploy standardised data models for telemetry, alarms, ontologies and topologies per domain. Ensure cross-domain mapping so a single digital representation serves internal teams and partners with data products.

3 - TRUSTWORTHY AI FOR EVENT REASONING

Implement AI/agent systems focused on precision and explainability to provide fast, accurate root-cause analysis and remediation recommendations with situational and context awareness.

4 - AI DIGITAL FACTORY & OPERATIONS

Establish tools, processes and governance for rapid model development, deployment, monitoring and cost control (FinOps) to accelerate business value and sustain platform operation.

5 - PEOPLE AND CULTURE TRANSFORMATION

Reskill network engineers into “hybrid experts” combining network and data/AI capabilities, shifting from manual fixes to data-driven operations.



05

Where to Start
The Path to
Multi-Domain
Scale



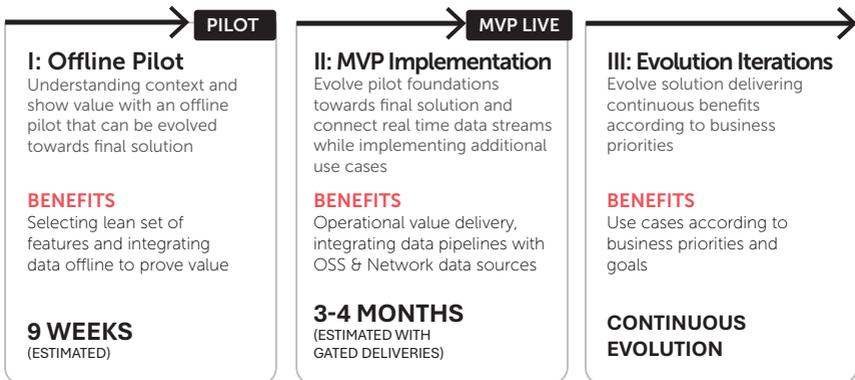
Where to Start

The Path to Multi-Domain Scale

LEAN APPROACH VISION

Think big, start small, move fast! From feasibility to iterations, beginning with a Pilot evolving quickly towards autonomy

FOUNDATIONS & KEY DECISIONS





06

Why Celfocus Proven Track Record in Telco AI

Making Data Actionable

Operating over 25 years in the Telco sector, we bring together business and technology experts to turn complexity into clarity and vision into measurable impact.



CLIENTS



PARTNERS



Why Celfocus?



Synergistic teams combining business, data, and AI expertise for B/OSS and networks



Proven track record with 5 of the top 6 European CSPs



Ready assets to accelerate delivery: functions & algorithms, data models & ontologies, and data collection & transformation

Lean approach & Delivery principles

Continuous Development

Using Agile best practices.

Continuous Deployment

Using automation and AI/ML at build, test and Deployment phases with Cloud solutions.

Continuous Collaboration

We combine business, Telco and data expertise, reviewing roadmap and team velocity to optimise allocation.

We do it differently!

We align stakeholders and support Telco strategy execution through Celfocus's Process Design and Facilitation Maps®, bridging the gap between Business, Network, OSS, AI/Analytics teams.



The Celfocus Team

Cognitive Automation Team



Carla Penedo
Executive Director of Cognitive Automation
carla.penedo@celfocus.com
(+351) 927 952 442



André Vieira
Cognitive Automation Senior Manager
andre.antunes.vieira@celfocus.com
(+351) 919 062 579



João Antunes
Head of Autonomous Networks
joao.antunes@celfocus.com
(+351) 961 314 746

Worth a Read

AI-Native Networks White Paper:



Network Digital Twin White Paper:



Telenet Case Study Article:



For more information about CELFOCUS,
please visit our website
www.celfocus.com

Copyright © CELFOCUS. All RIGHTS RESERVED TO CELFOCUS and its Licensors under Law. The disclosure, copying, adaptation, citation, transcription, translation, and/or any other form of total or partial use of the content, layout and graphic design, images or sound of this document or accessible herein, by any means of using any format (physical or virtual) without the respective authorization or licensing by CELFOCUS or its Licensors is prohibited and offenders shall be prosecuted. The user or licensee of all or part of this document may only use the document under the terms and conditions agreed upon with CELFOCUS and/or its Licensors for the purposes determined, otherwise subject to civil and/or criminal prosecution of the offenders.

CELFOCUS, S.A.

Avenida D. João II, Lote 34
Parque das Nações
1998-031 Lisboa, Portugal
Tel. +351 213 836 300. Fax +351 213 836 301
www.celfocus.com