



2035 - THE EDGE AI REVOLUTION: WHEN 80% OF AI MIGRATES TO THE EDGE

From centralized AI to distributed intelligence:
Technologies, Markets and Strategic Issues 2020-2035

Target Sectors

Industry 4.0, Healthcare, Smart Cities, Automotive,
IT & Telecom, Retail, Agriculture, Energy & Utilities



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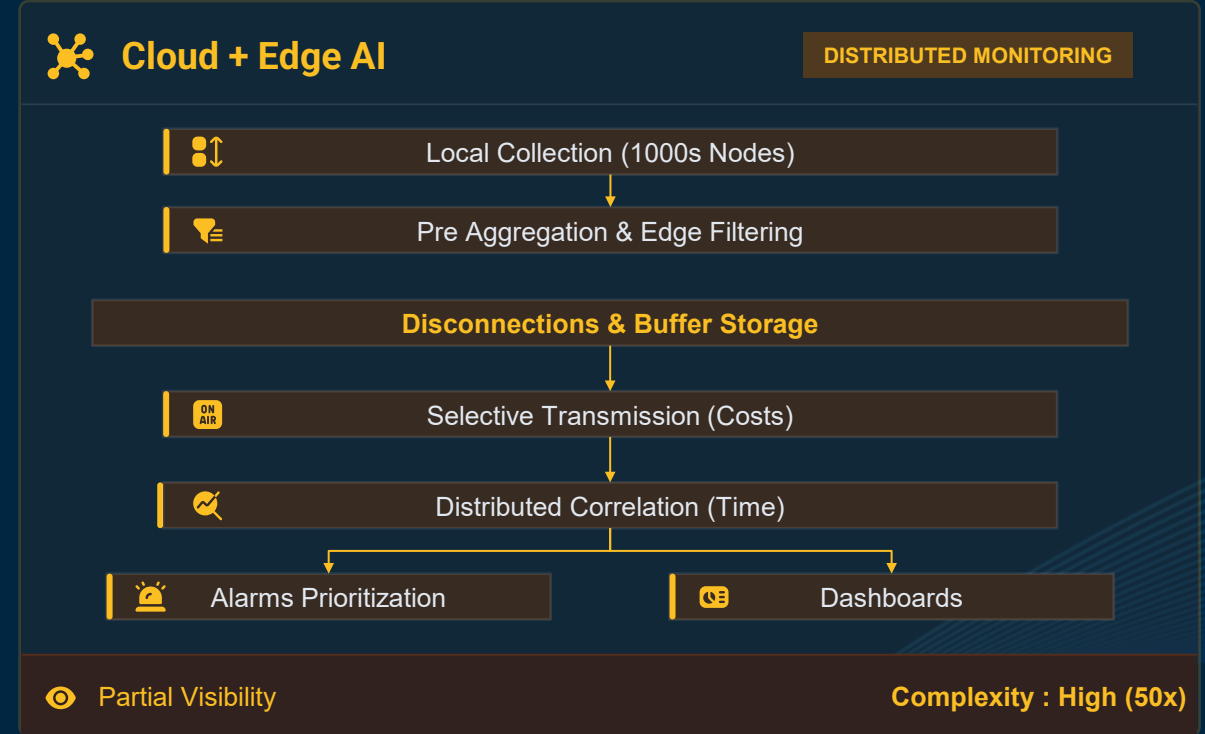
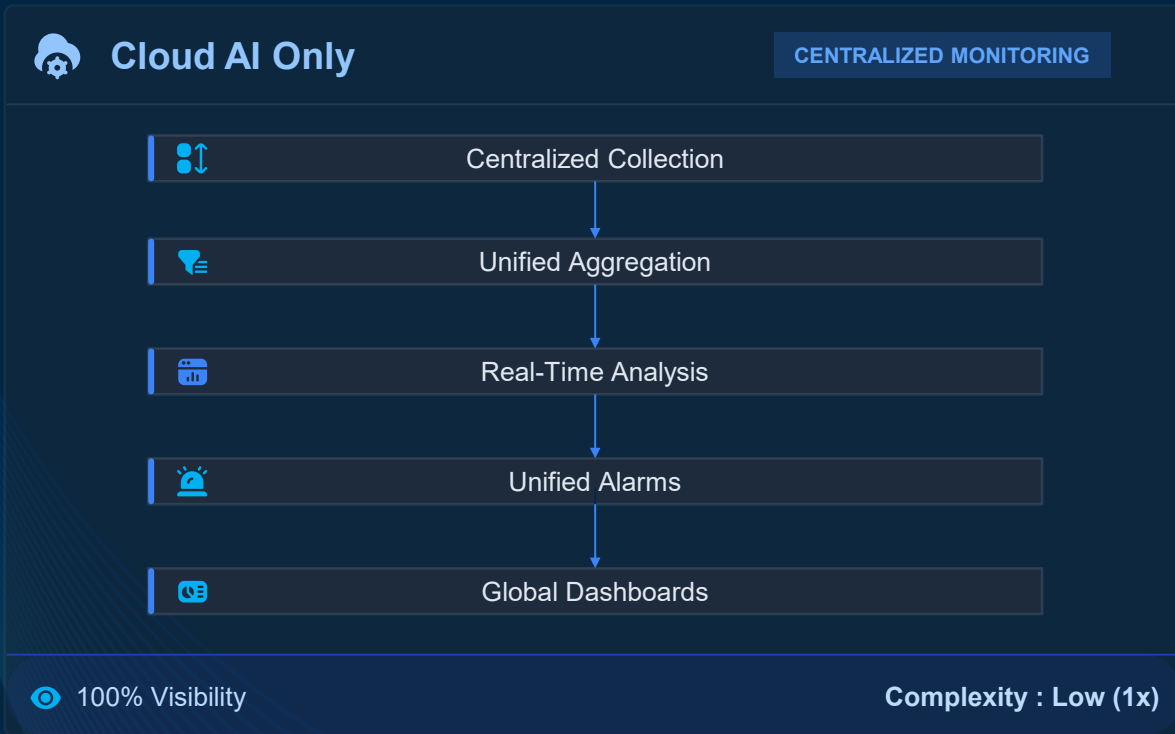
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SECTION 7 –
KEY PROCESSES & EDGE AI TCO

Monitor the Edge AI : 50x More Complex, 10x More Expensive

Comparative analysis of observability : From a unified centralized view to distributed blind spots

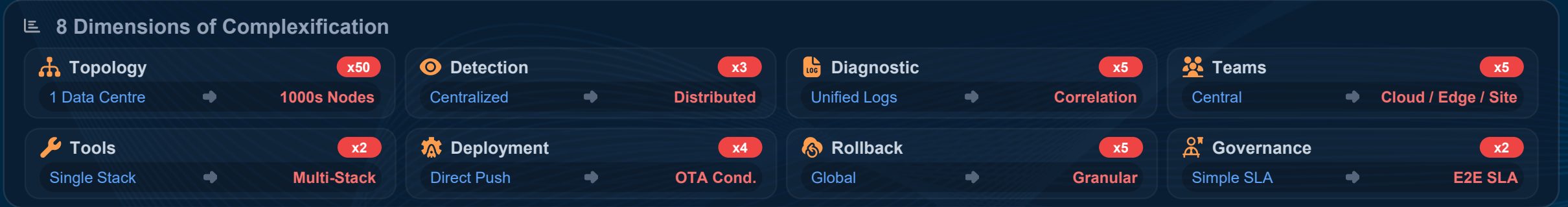
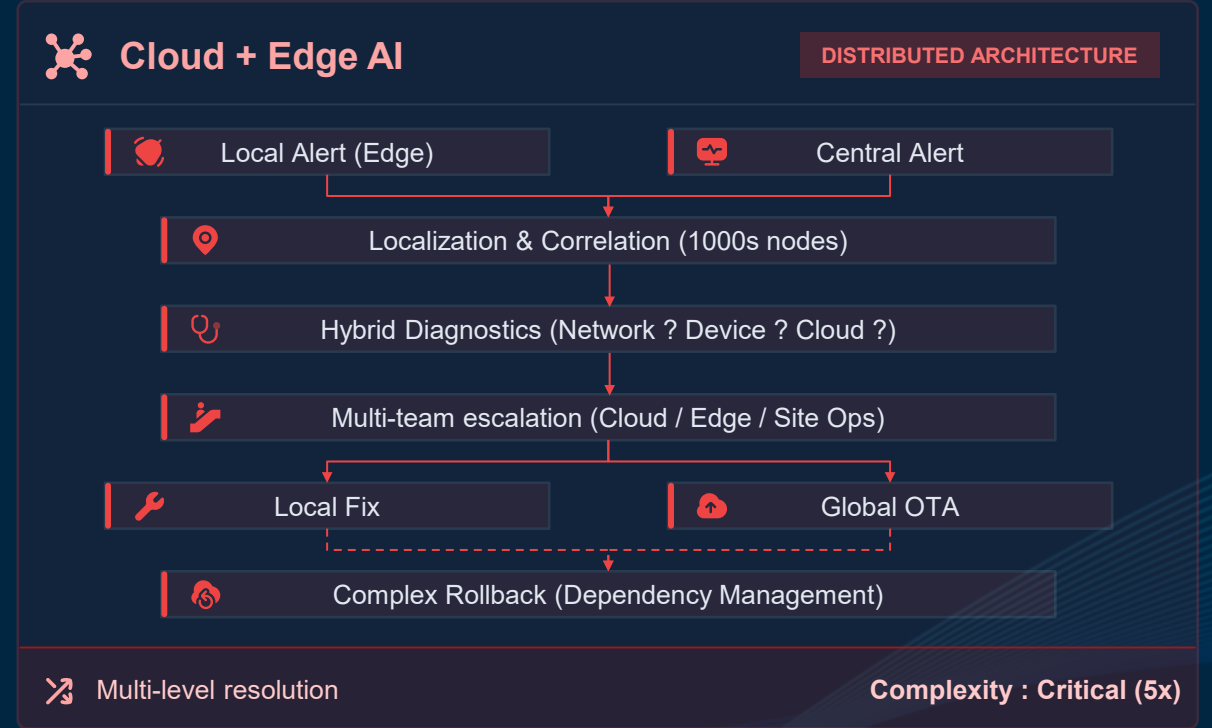
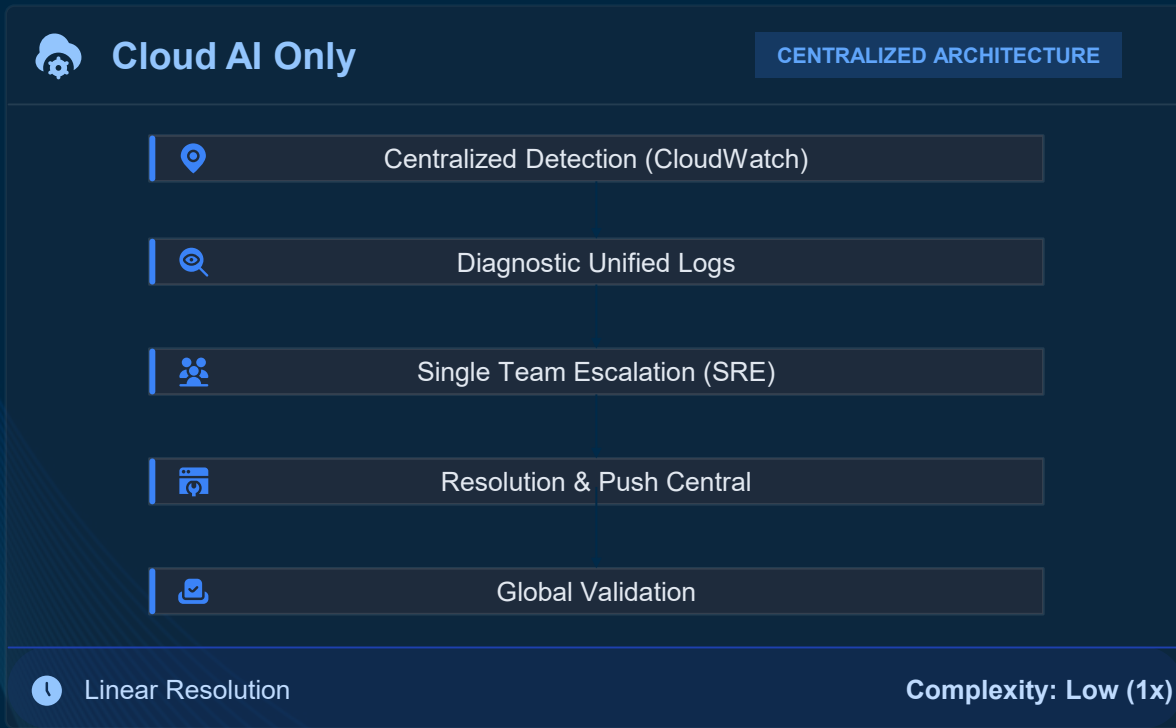


8 Dimensions of Complexification

<div style="display: flex; justify-content: space-between; align-items: center;"> Collection Point x1000 </div> <p>1 Data Centre → 1000s Nodes</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Data Volume x100 </div> <p>GB / Day → TB / Day (Dist.)</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Collection Latency x10 </div> <p>Real Time → Differed / Buffered</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Correlation x5 </div> <p>Direct → Multi Sources</p>
<div style="display: flex; justify-content: space-between; align-items: center;"> Alarms x3 </div> <p>Single Source → Multi Levels</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Storage x5 </div> <p>Centralized → Dist. & Aggregated</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Costs x3 </div> <p>Fixed → Variable (Trans.)</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Visibility x2 </div> <p>100% → Blind Zones</p>

Edge AI Incidents : Why 1000 Sites = Complexity × 5

Comparative analysis of the resolution chain : From centralized simplicity to distributed complexity



Change Management Edge AI : Why 1 Team Becomes 1000

Comparative analysis of change management : From uniform adoption to multi-site transformation

Cloud AI Only
CENTRALIZED AND LINEAR

- Single Planning
- Centralized Training
- Global Testing & Validation
- "Big Bang" deployment
- Post-Deployment Support

Uniform Adoption
Complexity : Low (1x)

Cloud + Edge AI
MULTI-SITES & WAVES

```

graph TD
    SP[Strategic Planning] --> CC[Cascade Communications]
    SP --> DT[Distributed Training]
    CC --> LP[Local Pilots POCs]
    DT --> LP
    LP --> CWD[Conditional Wave Deployment]
    CWD --> LV[Location Validation]
    CWD --> SA[Site Adjustment]
    LV --> MLS[Multi-level support]
    SA --> MLS
    
```

Heterogeneous Adoption
Complexity : High (10x)

8 Dimensions of Complexification

Teams Perimeter x50 1 Team → 1000s Dist.	Communication x5 Direct → Multi Level Casc.	Training x4 Centralized → Dist. / Cultural	Adoption x3 Uniform → Heterogenous / Site
Resistance x5 Centralized → Geographically Dist.	Timeline x3 Linear → Cond. Waves	Governance x2 Centralized → Local Autonomy	Success Measurement x2 Central KPIs → Multi Level KPIs

AI Edge Security: Attack Surface × 100, Compliance × 10 Jurisdictions

Comparison of security challenges : From the centralized model to distributed multi-site governance

Cloud AI Only
CENTRALIZED PERIMETER

Threat Detection

Centralized Analysis

Unified IAM

Synchronous Global Patch

Conformity Validation

Single Jurisdiction
Complexity : Low (1x)

Cloud + Edge AI
SURFACE x 100

Local / Central Detection

Correlation

Isolation Node

Physical Access / Model Poisoning

Zero-Trust Authentication / KMS Edge

Conditional OTA Patch

Multi Jurisdictions Validation

Multi Jurisdictions
Complexity : Critical (100x)

8 Dimensions of Complexification

<div style="display: flex; justify-content: space-between; align-items: center;"> Attack Surface x100 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> 1 Data Centre → 1000s Nodes </div>	<div style="display: flex; justify-content: space-between; align-items: center;"> Authentication x5 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> IAM Central → Zero Trust </div>	<div style="display: flex; justify-content: space-between; align-items: center;"> Encryption x5 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> Centralized Keys → KMS Edge </div>	<div style="display: flex; justify-content: space-between; align-items: center;"> Compliance x10 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> Unique → Multi Jurisdictions </div>
<div style="display: flex; justify-content: space-between; align-items: center;"> Audits x5 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> Centralized → Distributed </div>	<div style="display: flex; justify-content: space-between; align-items: center;"> Patching x3 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> Global Sync. → OTA Cond. </div>	<div style="display: flex; justify-content: space-between; align-items: center;"> Isolation x5 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> Network → Micro Segment </div>	<div style="display: flex; justify-content: space-between; align-items: center;"> Governance x3 </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 5px;"> Central Policy → Multi Level </div>

CAPEX x 50, OPEX -47% : The Economic Paradox of Edge AI

Comparative Financial Analysis : From pure OPEX predictability to profitable CAPEX/OPEX hybridization

Cloud AI Only
PREDICTABLE COSTS

- Unique Estimate
- Cloud Provisioning
- Usage (Pay-As-You-Go)
- Monthly Billing
- Simple Optimization

Linear & Predictable
Complexity : Low (1x)

Cloud + Edge AI
HYBRIDE & VARIABLE

- Multi Components Estimate
- Initial Edge CAPEX (High)
- High CAPEX & Obsolescence
- Distributed Deployment
- Variable Transmission Costs
- Sites Maintenance

Hybrid Billing

Variable & Complex
Complexity : High (10x)

8 Dimensions of Complexification

<div style="display: flex; justify-content: space-between; align-items: center;"> CAPEX Structure x50 </div> <p style="font-size: small; margin-top: 5px;">1 Data Centre → 1000s Nodes + Infra</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Compute OPEX x5 </div> <p style="font-size: small; margin-top: 5px;">Centralized → Hybrid Distributed</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Transmission x3 </div> <p style="font-size: small; margin-top: 5px;">Egress Fees → Bidirect. Variable</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Maintenance x10 </div> <p style="font-size: small; margin-top: 5px;">Centralized → Local Multi Sites</p>
<div style="display: flex; justify-content: space-between; align-items: center;"> Energy x2 </div> <p style="font-size: small; margin-top: 5px;">Opt. Data Centre → Distributed Non-Opt.</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Vendors x5 </div> <p style="font-size: small; margin-top: 5px;">1 / 2 Vendors → Multi-Vendors</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Predictability x3 </div> <p style="font-size: small; margin-top: 5px;">Linear → Variable + Peaks</p>	<div style="display: flex; justify-content: space-between; align-items: center;"> Optimization x5 </div> <p style="font-size: small; margin-top: 5px;">Simple (Resource) → Complex (Cache)</p>

€360 Million in Savings Over 10 Years: A Business Case for Edge AI

Comparative Economic Model: The Winning Bet of the Initial Edge Investment

Assumptions (Reference Basis)

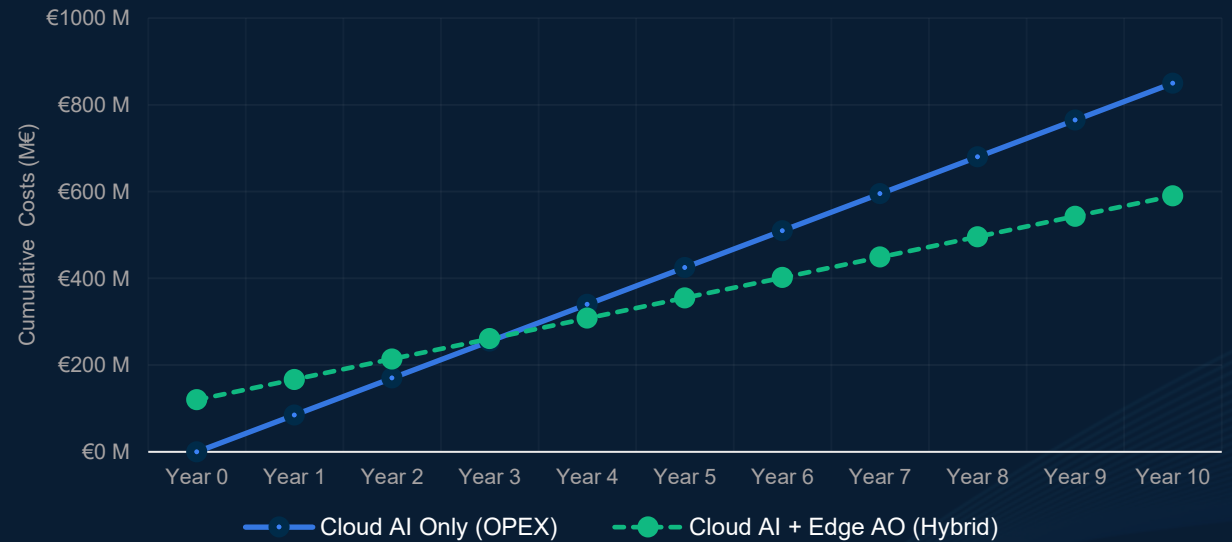
- Scope: 1000 Industrial Sites
- Load: Compute Intensive AI
- Period: 10 Years (2025-2035)
- Unit: Millions of Euros (€M)

Comparative Cost Structure

Cost Item	Cloud AI Only	Cloud + Edge AI	Delta
CAPEX (Initial Investment)			
Infra & Devices	0 M€	120 M€	+120 M€
OPEX (Annual Costs)			
Compute & Storage	48 M€	23 M€	-52%
Transmission (Egress)	20 M€	4 M€	-80%
Maintenance & Energy	0 M€	8 M€	N/A
Licences Soft	5 M€	4 M€	-20%
Total OPEX / Year	73 M€	39 M€	-47%
FTE (Human Resources)			
Ops/Support Teams	50 FTE	80 FTE	+60%
Annual FTE Cost	4 M€	8 M€	+100%
TOTAL ANNUAL	77 M€	47 M€	-39%

Cumulative TCO Evolution (€M)

Break-even point at 4 years (CAPEX amortization)



€300 M

Savings over 10 years



3.2 years

Break-even point



-39%

Annual Cost Reduction




Strategic Insight: The hybrid model requires a **high entry ticket (€120M)** and increased HR complexity, but generates **massive efficiency gains** from the 4th year onwards thanks to the collapse of transmission and cloud compute costs.



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