Towards a Business Process Driven Deployment and Decomposition of a Distribuited Jurisditional Information Management System on Cloud Continuum

Beniamino Di Martino, Luigi Colucci Cante, Mariangela Graziano, Rocco Aversa, Pietro Lupi

Abstract In an increasingly complex context, where regulatory compliance and operational efficiency must coexist, it is not always easy to ensure privacy aspects in the management of business processes. In legal systems, in order to allow judges to make decisions or third parties, such as court-appointed experts (Consulenti tecnici di Ufficio - CTU) to carry out technical examinations, a large amount of sensitive data is stored in information systems, forcing the actors involved to take responsibility for the short- or long-term preservation of data. This paper aims to propose an innovative approach for the design and deployment of a distributed system for the management of jurisdictional information based on the cloud continuum. The aim is to divide data management between and edge, fog and cloud infrastructure, reducing the concentration of responsibility on a single actor in the process. This ensures more secure, scalable and compliant management without sacrificing the operational efficiency of the legal system.

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1 Introduction

This paper aims to analyze and describe how software components and data can be deployed on the "Cloud Continuum" [15] following a flow of procedural activities modeled according to the Business Process Model and Notation (BPMN) standard [4]. As an illustrative case study, the justice domain is considered, specifically ordinary civil procedure pre-Cartabia reform.

The main objective is to ensure the efficient use of available resources, ensuring safety and regulatory compliance, with an approach that promotes interoperability among the different actors in the process [1].

The increasing complexity of software applications and evolving IT architectures have driven the adoption of the "Cloud Continuum" as an innovative approach to deploying software and data components [1]. This model is based on the integrated management of distributed resources between centralized cloud, edge computing and local devices, providing flexibility and scalability [3, 11]. In this context, the use of process modeling through BPMN allows activities to be orchestrated in a clear, standardized and business-compliant way.

Cloud continuum adoption is particularly relevant for complex domains such as justice, where process efficiency and secure data management are priorities [2]. In this scenario, the Cloud Continuum represents a promising solution for: i) centralize and distribute data dynamically, ensuring fast and secure access to the information needed for proceedings; ii) optimize IT resource utilization with balanced management between cloud and edge infrastructures; iii) support collaboration between different actors (judges, lawyers, clerks) through shared platforms; iv) integrate new digital tools with pre-existing processes, reducing resistance to change.

2 Odinary Civil Trial pre-Cartbia Reform in Italy

The case study analysed in this article is the "*ordinary civil trial pre-Cartbia reform*". For a clear understanding, of the actors and actions involved, a modelling in BPMN is proposed, which is shown in Figure 1.

Before commenting on the stages of the BPMN, a preliminary statement should be made. The civil trial is characterised by the principle of availability of evidence ("*Onere della prova*"): it is the parties who must prove what they claim in court (Article 2697 Civil Code[1]). The parties have the evidentiary burden of bringing evidence before the judge, whether it be documents physically transferred to the clerk's office at the disposal of the judge, or instructive evidence, such as witnesses (the witness must be brought to the hearing to be interrogated to answer those questions that the parties want to ask him and that the judge has deemed relevant in his order of admission of evidence). In this case study, it is assumed that evidence and data need not necessarily be indicated by the parties not transit through storage systems owned

[1] https://www.brocardi.it/codice-civile/libro-sesto/titolo-ii/capo-i/art2697.html

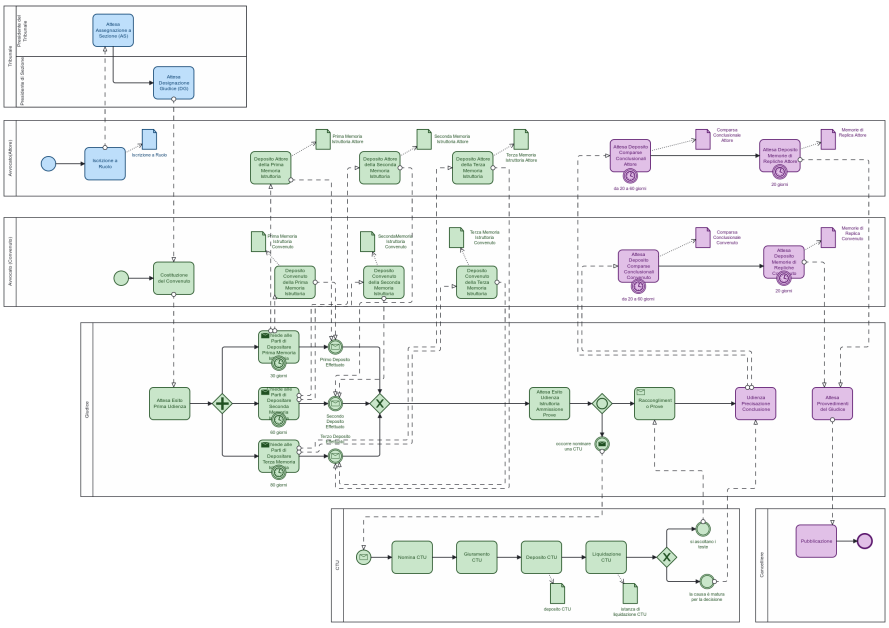

Fig. 1: Ordinary Civil Trial pre-Cartbia Reform

by the lawyer or the court office, but may be accessed directly, without being stored, at external source [5]s.

As can be seen from Figure 1, the process consists of three different stages, highlighted by different colours, described below.

Introductory Phase - Fase Introduttiva

This phase is highlighted in blue in the BPMN in Figure 1. The plaintiff, through his or her lawyer, register the claim by filing the application initiating with the attached documentation including an XML file containing all the metadata that values the fields of the chancellery programme for entry in the register. The lawyer uses drafting software to create an envelope to be attached to the message, so as to comply with *PCT - Processo Civile Telematico (Online Civil Trial)* rules [14, 8]. The acts and documents filed by the lawyer travel via PEC within an attachment with the extension ”*.enc*” and arrive in the chancellery register, where they are stored. The registration of the claim results in the creation of an electronic dossier with its own identifier: the ”*role number*” code. The President of the Court assigns the dossier to a specific chamber, and the President of the chosen chamber nominates a judge.

The defendant’s lawyer, after verifying the role number that the chancellery register programme has assigned to the dossier created by the plaintiff, deposits the ”*appearance act - comparsa di costituzione*” and the evidentiary documents that he

considers relevant, again using the PEC with an ".enc" envelope and an XML file inside that also contains the dossier identifier.

Investigatory Phase - Fase Istruttoria

This phase is highlighted in green in the BPMN in Figure 1. The judge, after examining the documents produced by the plaintiff and the defendant through his portal, hears the parties at an initial hearing: if he does not find any procedural anomalies, he fixes, by an order at the foot of the report that he himself draws up, the three deadlines for the parties to deposit the "*memorie istruttorie (preliminary pleading)*".

The plaintiff and defendant deposit, within the time limit set by the judge, the three preliminary pleading; if they so desire, they may also deposit additional documents. The judge, after the third time limit for deposit of preliminary pleadings, through his portal, examines all the documents deposited by the parties and decides whether and how to instruct the case (examination of witnesses, request a technical consultancy, etc.) by means of an order.

If the judge decides to nominate a *CTU - Consulenza Tecnica d'Ufficio (Technical Consultancy Office)*, the order is notified to the consultant by PEC, retrieving the email address from the "*General Register of PEC addresses*" managed by the italian "*Ministry of Justice*".

The CTU, after receiving notice of being nominated: i) deposits the "*acceptance act and oath*" in the chancellery register telematically (according to the same procedure used by lawyers); ii) summons and listen to the parties; iii) examines the dossier by means of the remote consultation services of the "*PST - Portale dei Servizi Telematici (Telematic Services Portal)*"; iv) draws up his technical report, which he deposits, together with its attachments, telematically in the dossier; v) Likewise, he also deposits the request for compensation.

Decision Phase - Fase Decisionale

This phase is highlighted in purple in the BPMN in Figure 1.

With the "*Udienza Precisazione Conclusione (Conclusion Hearing)*", the judge assigns a time limit for the deposit of "*conclusion pleadings (Memorie Conclusionali)*", in which the parties attempt to convince the judge of their reasoning at the end of the investigatory phase. The parties submit their conclusions and have further time to reply to what the other party has written with "*rejoinder pleadings (Memorie di Repliche)*".

The judge decides the case by drafting the judgment and depositing it with its portal in the chancellery register. Finally, the chancellor accepts the judgement of the court in the register by assigning it a number and communicates it to the parties.

3 Architecture of Italian Ordinary civil procedure

In Section 2 the Italian civil procedure before the Cartabia reform was analysed. This procedure is characterised by a complex sequence of activities involving different actors and heterogeneous systems. A UML Component Diagram depicting the architecture implementing the procedure described in Section 2 is shown in Figure 2.

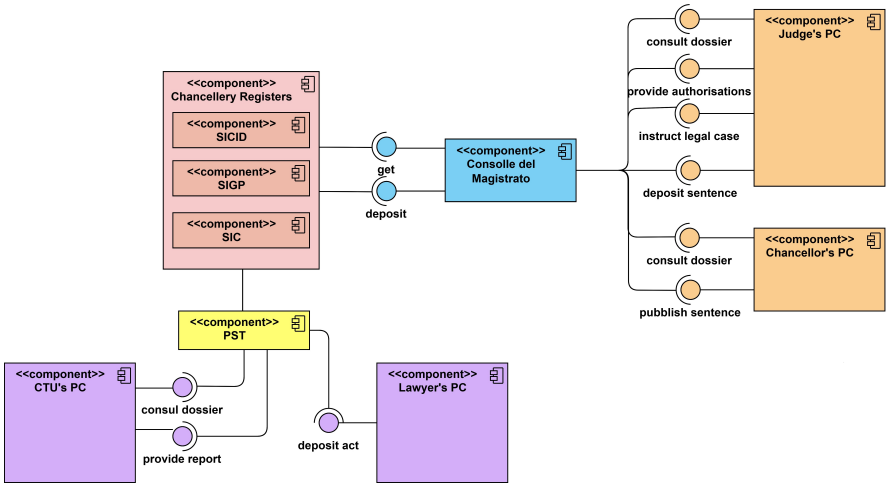

Fig. 2: UML Component Diagram of Ordinary Civil Trial pre-Cartbia Reform

As can be seen from Figure 2, the architecture comprises several components described below:

- **Judge and Chancellors's PC**: devices provided to the internal personnel of the justice domain, i.e. judges and court clerks, through which it is possible to access the "Magistrate's Console".
- **Consolle del Magistrato**: software that allows parties within the justice domain to access chancellery register, consult or deposit documents. In particular, through it judges can depose their sentences and orders, they can acquire and consult acts and documents of dossier (application initiating, preliminary pleading, conclusion pleadings, etc.), and they can provide authorisations to allow persons outside the justice domain (e.g. CTUs and lawyers) to access the dossier.
- **Chancellory Registers**: datacentres where court files are physically stored. Through it, documents are shared between personnel inside and outside the justice domain, avoiding responsibility problems. They are subdivided by type: i) **SICID (Sistema Informativo Contenzioso Civile Distrettuale)** is the system used in courts and courts of appeal to handle ordinary civil proceedings; ii) **SIGP (Sistema Informativo Giudice di Pace)** is is the system intended for the man-

agement of civil cases at Justice of the Peace offices; iii) **SIC (Sistema Informativo Cassazione)** is the system used for case management at the Court of Cassation.

- **Lawyers and CTU's PC**: personal computers of persons outside the justice domain, such as lawyers and consultants. In these devices, the documentation of plaintiffs and defendants, such as testimony, pleadings, writ of summons, etc., is physically stored.
- **PST (Portale Servizi Telematico)**: tool provided by the Ministry of Justice for the digital use of numerous services in the civil and criminal fields aimed at professional users (lawyers, accountants, CTUs, etc.) and non-professional users (private citizens, associations, etc.). For example, after nomination, a judge can enable access to the dossier for a CTU, who can view it on the PST for a limited period. The CTU enters the PST with *SPID*[2] or *CNS*[3] and, after authentication, can access the documents in the dossier without having to download or store them locally. The PST does not contain dossiers and documents, but works as an intermediary allowing authorised users (CTUs, lawyers, parties) to consult documents already registered in SICID/SIGP/SIC systems.

A UML Deployment Diagram is shown in Figure 3, which provides indications regarding the deployment of the components illustrated in the Component Diagram in Figure 2 on the actual IT systems used in Italy in the field of justice.

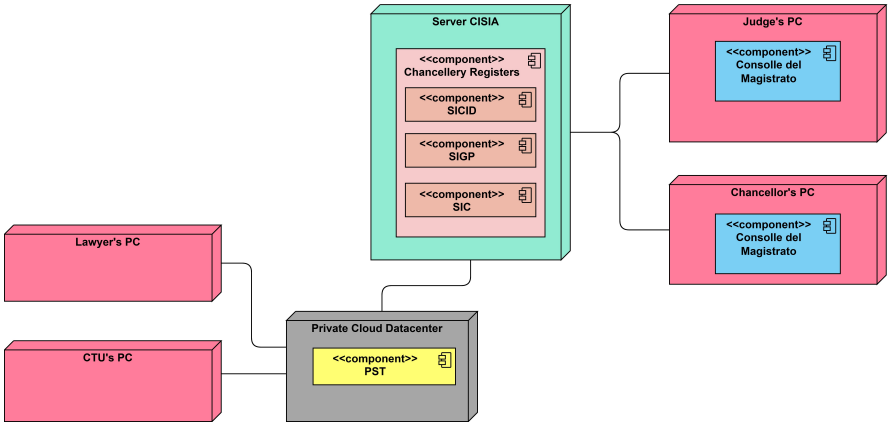

Fig. 3: UML Deployment Diagram of Ordinary Civil Trial pre-Cartbia Reform

[2] SPID (Sistema Pubblico di Identità Digitale) is the single system for access with a digital identity to the online services of the Italian public administration and its private members. Citizens and businesses can access these services with a unique digital identity that allows access and use from any device.

[3] CNS (National Services Card) is an Italian personal document that contains tax and health information and enables the use of various public services.

Figure 3 shows an architecture based on three types of elements: red shows the edge devices, green shows the on-premise servers and grey shows the cloud part. The "*Consolle del Magistrato*" is software installed directly on the personal computers of judges and court clerks. The chancellery registers as SICID, SIGP and SIC are deployed on CISIA[4] servers, distributed in different locations in Italy in order to keep the data closer to the various courts and reduce the latency for accessing them. The PST, on the other hand, is deployed on a Private Cloude Datacenter.

The computers of the parties (lawyers, CTUs, etc.) and judges and court clerks are edge devices used essentially for read and/or write access to the chancellery registers, which act as a single point of storage of judicial data, which can be accessed in two ways: with the "Consolle del Magistrato" for subjects within the justice domain, and with the PST for external parties.

4 A Cloud Continuum Approach

The architecture described in Section 3, already succeeds in guaranteeing privacy and responsibility, as the exchange of documents only takes place through access to the chancellery registers, which is done via secure channels protected by efficient security systems.

However, the main stages of the process, from registration to final decision, include highly bureaucratic and often manual activities, such as the collection, management and analysis of legal documents. With a view to digital transformation, a continuum-based cloud approach is proposed in Figure 4 that makes some improvements to the architecture illustrated in Section 3.

The solution proposed in Figure 4 consists of four layers, described below:

1. **Edge Devices Layer**: includes edge devices used to deposit or consult documents, i.e. the personal computers of judges, chancellors, lawyers and consultants.
2. **Edge Node Layer**: includes local servers placed nearer to the justice domain, so as to reduce latency for accessing documents. Thus, the uploading and storage of legal documents could be distributed on edge nodes located at the courts. These servers provide a level of autonomy for judicial offices, allowing business continuity even in the event of disconnection from central servers. The usefulness of local servers would not only be limited to storage, but also to processing documents in a way that optimises the work of judges and chancellors. For example, one could think of automatically verifying, with artificial intelligence techniques [6], the reliability of evidence presented by witnesses, so as to detect any inconsistencies [13]. For example, by comparing the description of a witness with the weather data of the time indicated by the witness, or by comparing the location

[4] CISIA (Consorzio Interuniversitario Sistemi Integrati per l'Accesso) is an italian non-profit consortium, formed exclusively by state universities, which supports universities in the realisation and delivery of entrance tests and tests of knowledge for entry to university courses.

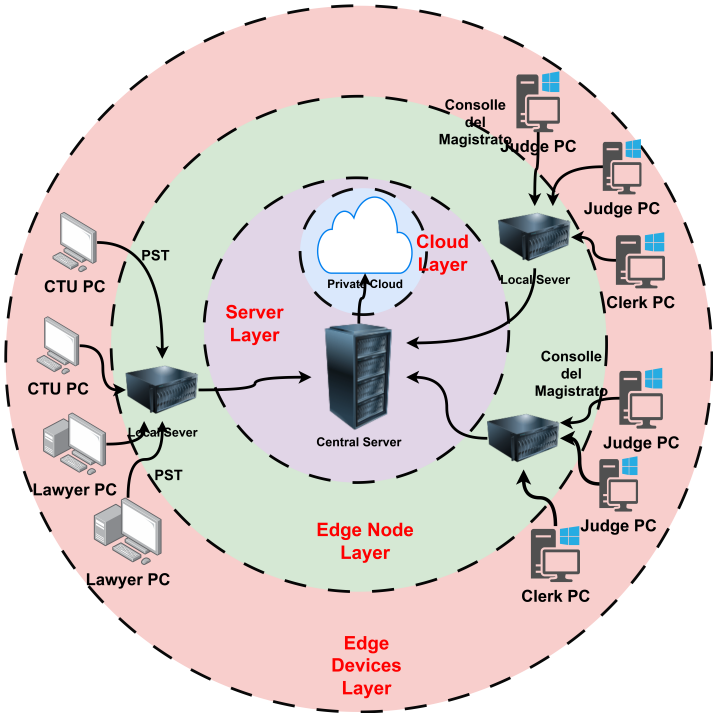

Fig. 4: Proposed Cloud Continuum-based Architecture

indicated by the witness with the data available from street maps. For parties outside the justice domain, on the other hand, local servers could perform document deposit support operations. For example, for lawyers they could perform drafting operations to create and send documents in XML format via PEC, or they could perform preliminary checks to verify the correctness of the document and/or compliance with constraints and regulations [9, 7].

3. **Server Layer**: includes one or more on-premises central servers that maintain data replication, and serve as an interface for acquiring documents deposited by parties outside the justice domain.
4. **Cloud Layer**: central servers can deposit "less sensitive" documents into private cloud storage after they have practiced anonymization on them [12]. Using artificial intelligence/cloud computing services, due to the opportunities provided by a cloud environment, such as scalability, computationally onerous analysis operations are performed. For example, predictive analysis [10], large-scale documentary research, finding common patterns among different trials, etc.

5 Conclusion

The proposed deployment leverages the potential of the "Cloud Continuum" to build a resilient, scalable, and compliant digital ecosystem. The use of edge, local, and cloud technologies balances efficiency, security, and flexibility. This approach not only meets the needs of the pre-Cartabia civil process, but also represents a model that can be applied to other domains, ensuring innovative and sustainable management of technology resources.

The proposed approach could make a significant contribution to reducing the time and operational costs of the civil process, improving the overall efficiency of the court system. However, the transition to this model requires careful planning and training of those involved, such as judges, lawyers, chancellors and consultants, to ensure its successful implementation.

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