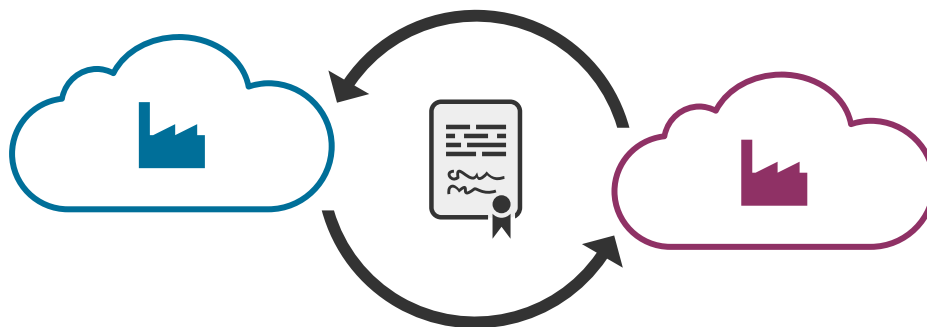|	Document title	Document type
	Intercloud Contract Negotiation and Automation	**SoSD**
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Intercloud Contract Negotiation and Automation
System-of-Systems Description

Abstract

This document describes how to use the Arrowhead Contract Proxy system in two or more interconnected system-of-systems, each operated by a different stakeholder, to facilitate digital negotiation of legally binding contracts. The described topology could, for example, be useful as a starting-point for automating component ordering, delivery tracking and payment; for granting access to Arrowhead services in exchange for commitments to pay by invoice; or for automatically buying and selling insurances, invoices, or other financial instruments.

	Document title	Version
	Intercloud Contract Negotiation and Automation	**0.2**
	Date	Status
	2020-06-05	**Work-In-Progress**
		Page
		2 (7)

ARROWHEAD

Contents

With the advent of the Industry 4.0 paradigm, manufacturers, transportation firms, as well as financial and legal institutes are expected to become increasingly integrated. For this integration to be of practical utility, there has to be ways for computers and other machines to drive or assist in the collaborative processes occurring between these entities. In particular, the manufacturing system of the future might have to independently order components, buy transport insurance, vow not to reveal sensitive information in digital twins to third parties, among many other kinds of legally binding commitments.

1   Overview

In this document, it is outlined how the Arrowhead Contract Proxy (CoPx) system can be used in a system-of-systems of two or more distinct Arrowhead local clouds, each assumed to be operated by an independent stakeholder wanting to digitalize and operate some aspects of their collaborations. The reader is assumed to have read, as well as having ready access to, the SysD document describing the CoPx system. Furthermore, information about the Arrowhead Event Handler, Gatekeeper, Gateway, as well as the Service Registry, Authorization and Orchestration systems are assumed to be had. While the roles of these systems are described briefly, more details about them will be required to set up concrete system-of-systems making use of the Arrowhead Contract System.

The rest of this document is organized as follows: In Section 2 a generic system-of-systems topology is outlined, which can be extended to facilitate many forms of contract automation needs. In Sections 3 and 4, two concrete use cases are presented. In the former use case, access to an Arrowhead service is given in exchange for invoice payments. In the latter use case, two manufacturers utilize a carrier to transport ordered components between themselves.

1.1   Status of this Document

At the time of writing, no implementations exist of the CoPx system. As we want to have time to evaluate such implementations before describing any use cases, there are not yet any use case descriptions in this document. If you have expectations or input regarding use cases, please contact Emanuel Palm <emanuel.palm@ltu.se>.

Document title
Intercloud Contract Negotiation and Automation
Date
2020-06-05

Version
0.2
Status
Work-In-Progress
Page
4 (7)

2   Archetypical System Topology

For a CoPx system to be used fruitfully, it must be possible for it to

1. connect to CoPx systems in other local clouds,

2. publish contractual events within its own local cloud, as well as

3. receive instructions regarding what offers to make, accept or reject.

The first requirement can be satisfied by using the Arrowhead Gatekeeper and Gateway systems, out of which the former allows for negotiating connections to other local clouds while the latter facilitates making connections to those clouds. The second requirement necessitates using an Arrowhead Event Handler System, which provides publish/subscribe messaging capabilities. The third requirement can only be satisfied by using one or more so-called *agent systems*, which are expected to either be controlled by humans or to know themselves how to behave in response to certain kinds of offers and other contract events. Apart from the mentioned systems, the Service Registry, Authorization and Orchestration systems can be used to facilitate system inerconnection and secure communications.

   An example of a system-of-systems where two Arrowhead Contract Systems are connected, each part of a distinct local cloud, is given in Figure 1.

Figure 1: Two distincts but interconnected Arrowhead local clouds, each understood to be operated by a different stakeholder. Each local cloud hosts a CoPx system, which provides the cloud in question with a single legal identity and a standardized way of publishing information about contractual events. The CoPx systems are utilized by *agent systems*, which use them to relay and receive contract offers, acceptances and rejections. Note that while the figure only depicts two local clouds, there is no theoretical limit to the number of local clouds any given CoPx system can interact with. In particular, the use case in Section 4 has three interconnected local clouds.

   For more information about the CoPx system and the services it provides, please consult the Contract Proxy system description. If wanting to learn more about the kind of digital legal contracts handled by the CoPx systems, please refer to the Contract Negotiation service description.

Document title
Intercloud Contract Negotiation and Automation
Date
2020-06-05

Version
0.2
Status
Work-In-Progress
Page
5 (7)

3 Use Case A: Selling Service Access

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Document title
Intercloud Contract Negotiation and Automation
Date
2020-06-05

Version
0.2
Status
Work-In-Progress
Page
6 (7)

ARROWHEAD

4   Use Case B: Coordinating Component Orders and Transportation

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Document title
Intercloud Contract Negotiation and Automation
Date
2020-06-05

Version
0.2
Status
Work-In-Progress
Page
7 (7)

5 Revision History

5.1 Amendments

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1				

5.2 Quality Assurance

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1			