

Channel Expansion for ServiceBC Contact Center at MAXIMUS Canada

by

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Master of Engineering, Chaitanya Bharathi Institute of Technology, 2012-2014

Bachelor of Technology, Institute of Aeronautical Engineering, 2008-2012

A MEng Project Submitted in Partial Fulfillment
of the Requirements for the Degree of

MASTER OF ENGINEERING

in the Electrical and Computer Engineering

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University of Victoria

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Supervisory Committee

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Abstract

ServiceBC is British Columbia's central government organization for delivering government information and services to citizens. It plays an important role in providing front line support for all the programs and services to government health and human service agencies. It uses contact center services from various clients across Canada to serve its residents. MAXIMUS Canada is one such client which provides its omni-channel contact center agent's support to ServiceBC for all healthcare needs. Currently, contact center at MAXIMUS Canada provides three modes of channels phone, text, email for its residents to communicate with agents. Using these channels residents still need to visit their nearby ServiceBC office for MSP validation, filling health related forms, submitting documents as part of verification, adding additional information on to their profile and so on. This process delays overall service time for end users especially residents living in remote locations. In this project, two new channels Video and Web chat along with Co-browse tool have been incorporated. With these, residents will be able to easily approach ServiceBC agents for their queries and quickly validate their health cards (MSP) without any delays virtually over a video chat, fill ServiceBC health related forms, submit documents as part of verification, add additional information on to their profile, share their screen to an agent and so on. As part on integration Cafe-X component, Fusion Web gateway helps in removing signaling complexity between client app and SIP endpoints and plays a major role in signalling conversions. Another important component, Fusion Media Broker helps to convert and adapt media between external clients and enterprise devices; for inbound traffic, simplifies & limits RTP for legacy devices; for outbound traffic adds additional features for browser & mobile clients. With the help of Fusion Web gateway, the incoming HTTP traffic is converted to the SIP signalling. Once a resident selects an option for communicating on ServiceBC website the request is directed through the Cafe-X solution. The request is sent to the MAXIMUS contact center via SIP trunks and is placed through respective queue for a ServiceBC agent. Once an available agent accepts the request there is a communication link is established over a secured network using reverse proxy server. In this project, the integration is done in few steps, requirements gathering, building UML diagrams, building use cases, product implementation. Once all the Cafe-X components are incorporated, all the enhanced features are tested through rigorous test phases exploratory testing, integration testing, functional testing followed by Business Acceptance testing. Defects for each phase are captured and tracked using defect tracking process in StarTeam based on priority to obtain a system with no major issues and least number of minor issues/warnings. The video chat feature is implemented in production after all the final test results are "pass" with no major defects. As a scope of this project, one ServiceBC agent can handle a maximum of one video chat/phone, three web chats, three texts, one co-browse session in parallel which can be extended in future.

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Acronyms

MSP	Medical Services Plan
SIP	Session Initiation Protocol
RTP	Real-time Transport Protocol
HTTP	Hypertext Transfer Protocol
UML	Unified Modeling Language
WHO	World Health Organization
BC	British Columbia
VoIP	Voice over Internet Protocol
RTC	Real-Time Communications
IP	Internet Protocol
PSTN	Public Switched Telephone Network
API	Application Programming Interface
SMS	Short Message Service
JPEG	Joint Photographic Experts Group
REST	Representational State Transfer
SDK	Software Development Kit
FAS	Fusion Application Server
FCSDK	Fusion Client SDK
PBX	Private Branch Exchange
TCP	Transmission Control Protocol
HA	High Availability
SDP	Session Description Protocol
AED	Application event Distribution
SRTP	Secure Real-Time Transport Protocol
DMZ	Demilitarized Zone
DNS	Domain Name System
STUN	Session Traversal Utilities
CentOS	Community Enterprise Operating System
RHEL	Red Hat Enterprise Linux
VGA	Video Graphics Array
CIF	Common Immediate Format
PCCE	Packaged Contact Center Enterprise
IDIM	Identity Information Management
UWF	Upstream Works for Finesse
IVR	Interactive Voice Response
URL	Uniform Resource Locator
VDI	Virtual Desktop Infrastructure
HIBC	Health Insurance BC
SBC	Service BC
BAT	Business Acceptance Testing
CR	Change Request

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Acknowledgments

I would like to express my sincere gratitude to my supervisors Prof. Chris Papadopoulos and Prof. Mihai Sima, to offer me a great opportunity to study at University of Victoria and for their generous support to complete this project with their valuable comments to enhance the quality of the dissertation.

I would like to pay my special regards to Mrs. Janine Roy, Director for Shared Applications at MAXIMUS Canada, for giving me an opportunity to undertake ServiceBC project. This helped me in collaborating with different teams and learn new concepts.

The physical and technical contribution of 'MAXIMUS Canada' is truly appreciated. Without their support and opportunity, this project could not have reached its goal.

Thanks to my parents, I am eternally grateful to them for their unconditional love and support. Dad, I miss you. I am especially thankful to my beloved husband who stood by me with all his love, support and motivation that helps me to follow my dreams.

Chapter 1: Introduction

1.1 Background:

Health can be defined as “a state of physical, mental, and social well-being and not merely the absence of disease or infirmity” [1]. Good health is a prerequisite for participation in a wide range of activities including education and employment. The act of taking preventative or necessary medical procedures to improve a person's well-being is termed as healthcare. This may be done with surgery, the administering of medicine, or other alterations in a person's lifestyle. These services are typically offered through a health care system made up of hospitals and physicians.

In every country, there are a number of interconnected systems or sectors, such as education, industry, agriculture, and transport. Their development has been shaped by the country-specific historical, cultural, geographic, and political context. One of these sectors is the health care system. Historically, medical care has been an important contributor to the health of society, helping to cope with disease or injury and in more recent times to prevent disease and promote health. With the rise of free trade and the exchange of goods and services, medical care has become one of many commodities and services sold in the marketplace. However, the development of parliamentary forms of government and growing social demands of the people has resulted in the concept of health care services as a public responsibility. Instead of healthcare services that can be bought and sold, the idea of providing healthcare to people based on their needs and in the interest of community welfare has emerged. This has resulted in the development of national healthcare systems. The different economic, political, and social settings of different countries mean that health care systems are naturally very diverse and vary in their structure and function, and in overall complexity.

With the formation of the World Health Organization (WHO) [2], the concept it promoted of health care as a human right has been reshaping world health policy. Its constitution promulgated in 1948 stated that the objective of WHO should be “the attainment by all peoples of the highest possible level of health.” This aim has influenced the formulation of health policies at both international and national levels. Consequently, the dependence of health care on market transactions in the private sector is now widely regarded as leading to social inequities and serious deficiencies in health care systems.

In Canada, Healthcare is delivered through the provincial and territorial systems of publicly funded health care, informally called as Medicare. Access to health care based on need rather than ability to pay was the founding principle of the Canadian health-care system. Medicare was born in one province in 1947. It spread across the country through federal cost sharing, and eventually was harmonized through standards in a federal law, the Canada Health Act of 1984. The health-care system is less a true national system than a decentralized collection of provincial and territorial insurance plans covering a narrow basket of services, which are free at the point of care. Administration and service delivery are highly decentralized, although coverage is portable across the country. In the setting

of geographical and population diversity, long waits for elective care demand the capacity and commitment to scale up effective and sustainable models of care delivery across the country [3].

Healthcare is provided to all the individuals who have a health card. Health cards are issued by provincial health ministries to individuals who enroll for the program in the province and everyone receives the same level of care [4]. There is no need for a variety of plans because virtually all essential basic care is covered, including maternity but excluding mental health and home care [5]. Infertility costs are not covered in any province other than Quebec, though they are now partially covered in some other provinces [6].

British Columbia is one of the provinces of Canada which has a healthcare system in good shape. There are number of programs and services offered by provincial government of British Columbia (BC) [7] for its residents, businesses and visitors. It has a health insurance scheme, Medical Services Plan (MSP) [8] operating under the auspices of the country's national Medicare program and administered by the government. MSP claims processing system is integrated with a web-based telecommunications system, Teleplan [9]. Teleplan is used by practitioners to securely submit from over 4,200 computer sites their claims, notes and eligibility requests to MSP, and receive payment statements, rejected claims and patient eligibility data from MSP through an encrypted Internet connection. Teleplan receives and processes over 5 million claims monthly, valued at approximately \$116 million. Approximately 95% of all claims are processed within 30 days, with the majority being paid within 14 days.

ServiceBC [10] is British Columbia's central government organization for delivering government information and services to citizens. It plays an important role in providing front line support for all the programs and services to government health and human services agencies. One of the major sectors for which ServiceBC provides support is Healthcare, it ensures that quality, cost effective, appropriate and cost-effective health services are available for all British Columbians. It mainly supports healthcare services such as Medical Services Plan (MSP), Pharmacare, HealthLink BC and Vital Statistics. Medical Services Plan (MSP) [8] is the public health insurance available in BC for all its eligible residents. It covers the cost of medically necessary insured doctor services. BC PharmaCare helps residents of BC with the cost of eligible prescription drugs, certain medical supplies, and pharmacy services. It aids through several drug plans. HealthLink BC is a healthcare website which provides all the information related to latest healthcare updates, healthcare solutions, health tests, tips for good health, links for healthcare providers, tools and videos on healthcare and much more by providing 24 hours a day, 7 days a week access to non-emergency health information and advice by phone, website, mobile app, and print. Vital Statistics provides Information on births, marriages, deaths, legal changes of name, adoptions, order certificates & copies and extracts, online birth registration, will notices, and government identification. ServiceBC uses contact center services from different clients across Canada to serve its residents. One such client is MAXIMUS Canada [11], which provides its omni-channel contact center agents support to ServiceBC for all its healthcare needs.

1.2 Motivation:

In day-to-day life, real-time communication plays an important role. A real time communication is that in which sender and receiver exchange their information and data over a channel without any delay. Usually, real time communication is termed to be as “Live Communication”. It belongs to peer to peer communication [12]. Applications of real time communication include instant messaging, internet telephony and VoIP, Video chat, Teleconferencing, Web chat, multimedia multicast, co-browse and so on. All these applications can be obtained using the real-time communication and collaboration solutions. There are number of providers which provides real time communication and collaboration solutions for mobile and web-based applications via video chat, web chat, co-browse, teleconferencing such as SightCall [13], VEE24 [14], Cafe-X [15], GENESYS [16], Salesforce [17], Blue Jeans Network, LIVEPERSON, Dialpad and many more. All of them are leading providers in this field and competitors for one another. Among all these providers, Cafe-X solutions is chosen in this project based on below reasons.

1. Initially, all the providers are studied briefly and compared with one another and it has been observed that all them provide almost equivalent technical features as others.
2. In this study it has been observed that Cafe-X produced extremely innovative software by bringing first WebRTC-to-SIP gateway and also with simple user-friendly display which this project demands for a government organization.
3. It has been observed that Cafe-X platform provides below services with WebRTC-to-SIP gateway conversion,
 - a) Voice: High-definition multiparty voice over IP and PSTN integration
 - b) Video: High-definition multi party video over IP
 - c) Screen Share: Real time screen streaming to one or more viewers
 - d) Chat: One-to-one and one-to-many text-based chat
 - e) Doc Share: Common shared view of documents
4. Cafe-X is proven to be providing a robust and secure application, allowing it to safely incorporate its components into a highly secure ServiceBC architecture at MAXIMUS Canada.
5. As part of project budget and negotiations, Cafe-X solutions has been chosen over other providers for its flexible packages and negotiable prices.
6. Cafe-X solution is also chosen for its high customer satisfaction reviews amongst all the providers, as in this project considering and taking post call interaction surveys is a major part with each and every citizen/resident.
7. Cafe-X solution is one amongst few providers who offer for time-based trial versions after implementing the product into production which avoids losses after production failures.
8. All events within the CafeX environment are optionally recorded, including simple content management, meetings and the transcriptions of meetings. Artificial Intelligence is applied to this rich set of data to determine where efficiency gains can be made.

9. The platform and API that has been built in Cafe-X over the years is rich and, as of the latest release, is simple and optimized for enterprise consumption.
10. Cafe-X addresses many of the key issues of implementing meetings today, while offering a solid configurable base for other use cases involving activity tracking and customer engagement.

Below Table 1 shows operational comparison between Cafe-X and its competitors,

Table 1: Operational Comparison of Cafe-X with its competitors

Company	Cafe-X: CafeX real-time communications software delivers one-click team collaboration, omnichannel customer service & remote agent coaching via mobile & web apps.	Dialpad: Dialpad is a cloud-based platform for enterprise communications that works across all personal devices.	AtScale: AtScale provides business intelligence platform designed to make business analytics work on big data.	BlueJeans: Blue Jeans Network is a company offering a cloud-based video collaboration service that enables video conferencing.	Guavus: Guavus is a big data analytics company developing apps that allow companies to embed data driven-decisions into agile businesses processes.	Salesforce: Salesforce is a cloud computing company that develops CRM solutions and provides business software on a subscription basis.	Genesys: Genesys (also known as Genesys Telecommunications Laboratories) is a company developing omnichannel customer experience and contact center solutions.	LivePerson: LivePerson is a technology company that develops products for online messaging, marketing, and analytics.
Founding Date	2013	2011	2013	2009	2006	1999	1990	1995
Type	Private	Private	Private	Subsidiary	Subsidiary	Public	Private	Public
Tags	Technology enterprise software, platform, telecommunications	Mobile & Telecommunications Technology cloud, enterprise software, messaging, platform, telecommunications, video	Technology business intelligence, enterprise software, machine learning, platform, telecommunications	Technology enterprise software, platform, telecommunications, video conference, video technology	Technology business intelligence, enterprise software, internet of things, platform, telecommunications	Technology cloud, cloud platform (PaaS), cloud services (SaaS), crm, enterprise software, sales automation	Technology cloud services (SaaS), customer experience, platform	Technology cloud, cloud services (SaaS), lead generation, messaging, sales automation
Locations	New York, US HQ	San Francisco, US HQ	San Mateo, US HQ	San Jose, US HQ	San Jose, US HQ	San Francisco, US HQ	Daly City, US HQ	New York, US HQ

Alexa Website Rank	326019	41317	361607	3825	380741	134	63127	108334
Employee Rating	3.9	3.6	4.7	3	2.7	4.4	4.4	3.3
Funding								
Latest funding round	\$ 18m (over 3 years ago)	\$ 50m (about 2 years ago)	\$ 50m (over 1 year ago)	N/A	N/A	N/A	\$ 900m (about 4 years ago)	N/A
Total funding raised	\$ 49.5m	\$ 120m	\$ 95m	\$ 175m	\$ 162.4m	\$ 65.4m	\$ 900m	\$ 43.9m

Currently, contact center at MAXIMUS Canada provides three modes of channels (phone, SMS, email) for its residents to communicate with ServiceBC agents as shown in Figure 1. With the help of these channels they still need to visit their nearby ServiceBC office for MSP validation, filling health related forms, submitting documents as part of verification, adding additional information on to their profile and so on. This process delays overall service time for end users especially residents living in remote locations by not allowing them to receive services until the process has been completed and verified manually. This leads to longer wait times which is leading to one of the major drawbacks in healthcare of Canada.

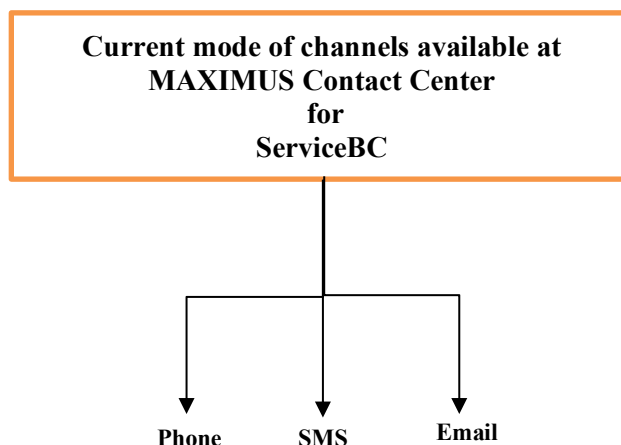


Figure 1: Channels available at MAXIMUS Canada before channel expansion

ServiceBC webpage having links for three modes of channels namely phone, text and email for “How would you like to get in touch?” under “contact us” tab as shown in Figure 2. Through this webpage users will have an option to select any mode of channel based on their convenience to connect with ServiceBC agent. As soon as the user clicks on any of the links, based on their selection the request will be sent to next available ServiceBC agent in the queue for assistance. When the agent accepts the request, a communication channel is established between them showing either parties basic information such as name and contact details to one another. All the conversations between agents and residents are monitored/recorded for quality and security purposes. If there are no available agents in the queue when the user initiates the channel, the request

stays in the queue or will be directed to the voice mail system based on business hours for ServiceBC. One ServiceBC agent can handle one phone, three text and any number of emails at a given time. The webpage also provides links for additional related contacts useful for the residents as shown.

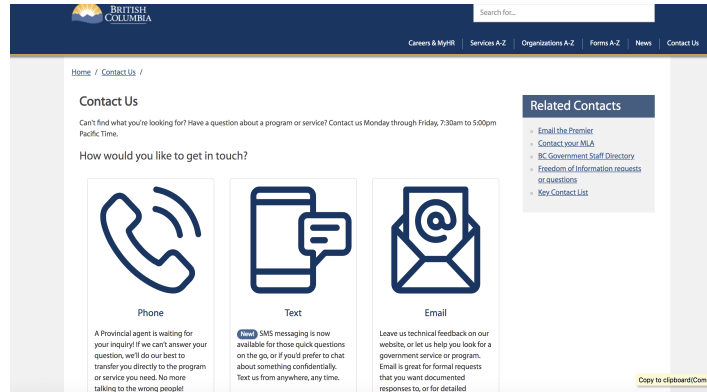


Figure 2: ServiceBC webpage before channel expansion

In today's technology, with advancements in communication industry virtual communicate on modes such as Video chat, Web chat and Co-browse tool are being introduced more often in every industry which reduces manual involvement, improves processing speeds and reduces processing times drastically. That said, in this project process involved for channel expansion of ServiceBC contact center at MAXIMUS Canada is discussed step by step. With the help of these additional channels, the processing time is reduced by eliminating the need for residents to manually visit ServiceBC office and providing all the services as quickly as possible with minimal wait times. Figure 3 shows modes of channels for ServiceBC after channel expansion project. With the help of these enhanced Omni-channel support, residents can prefer their most convenient means of communication, with continuity and consistency across channels to ensure that their journey remain seamless.

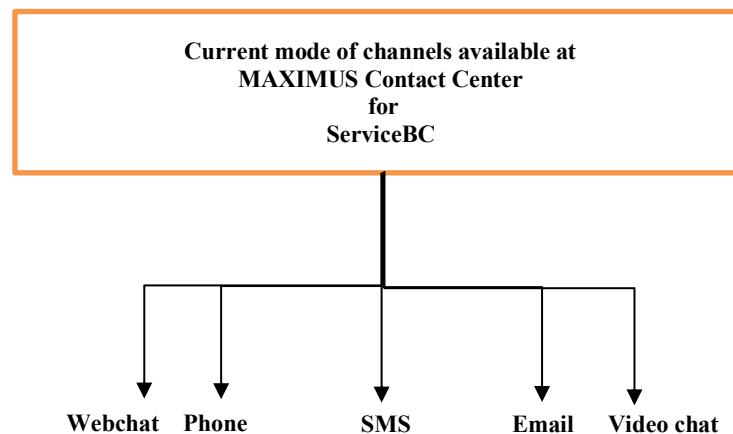


Figure 3: Modes of Channel at MAXIMUS CANADA after channel expansion

ServiceBC webpage having links for enhanced modes of channels namely video chat, web chat (Live chat) along with existing channels phone, text and email with co-browse

option for “How would you like to get in touch?” under “contact us” tab is shown in Figure 4. Through this webpage users will have an option to select any mode of channel based on their convenience to connect with ServiceBC agent. As soon as the user clicks on any of the links, based on their selection the request will be sent to next available ServiceBC agent in the queue for assistance. When the agent accepts the request, a communication channel is established between them showing either parties basic information such as name and contact details to one another. All the conversations between agents and residents are monitored/recorded for quality and security purposes. If there are no available agents in the queue when the user initiates the channel, the request stays in the queue or will be directed to the voice mail system based on business hours for ServiceBC.

Resident who is in contact with agent can request for co-browse session. Resident will click on an option “Already on call request for connection?” if they need want to have a co-browse session with the agent, as soon as the link is clicked the resident will be provided with a short code which needs to be shared with the respective agent for them to start the session. Once the agent enters the short code in their Finesse window, a live co-browse session is started between them and agent will now be able to see resident’s current page and will be able to assist in their queries by navigating through the page. One ServiceBC agent can handle one video chat or phone, three live chats, one co-browse, three text and any number of emails at a given time. The webpage also provides links for additional related contacts useful for the residents.



Figure 4: ServiceBC webpage after channel expansion

1.3 Channel Expansion for ServiceBC at MAXIMUS Canada:

Currently, ServiceBC contact center at MAXIMUS Canada provides three modes of channels phone, text and email for its residents to connect with agents for their queries. There are few major drawbacks observed with these channels such as, (1) BC residents had to visit there nearby ServiceBC office to activate there new MSP cards which may be a challenge for those living in remote locations and who may not be able to travel easily, (2) There can be delay in processing times and challenge of not receiving the health benefits until BC residents visit ServiceBC office to activate there health cards, (3)

Residents may have difficulty in explaining their queries on phone/text/email to ServiceBC agents such as virtually asking about the form details they are filling or details which they are seeing on the website etc., (4) Residents will not be able to share any details to agents like images, files on phone/text/email leading them to manually visit ServiceBC office every time they need to. By using enhanced modes of communication video, web and co-browse these drawbacks can be addressed by allowing BC residents to better communicate with ServiceBC agents regarding their queries and also allow them to virtually validate their health cards hence reducing delay in receiving health benefits. These drawbacks are addressed using the enhanced channels as shown in figure 5.

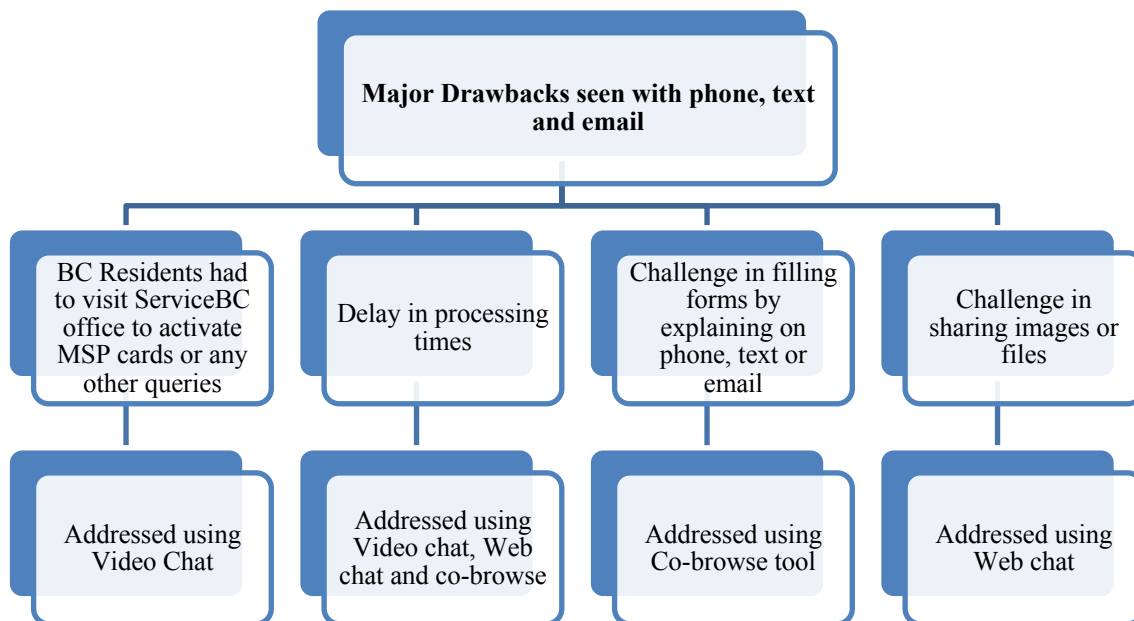


Figure 5: Drawbacks involved with modes before channel expansion

In this project for channel expansion for ServiceBC at MAXIMUS Canada, two new channels Video chat and Web chat along with Co-browse tool have been incorporated. With the help of these enhanced channels, residents will be able to easily approach ServiceBC agents for their queries and quickly validate their health cards (MSP) without any delays virtually over a video chat with an available agent, fill ServiceBC health related forms, submit documents as part of verification, add additional information on to their profile, share their screen to a ServiceBC agent and so on.

In order to obtain the enhanced features video chat, web chat and Co-browse, the Fusion Web gateway helps in removing signaling complexity between client app and SIP endpoints and plays a major role in signalling conversions. Fusion Media Broker is another important network component of Cafe-X which helps in converts and adapts media between external clients and enterprise devices; for inbound traffic, simplifies & limits RTP for legacy devices; for outbound traffic adds additional features for browser & mobile clients. With the help of Fusion Web gateway, the incoming HTTP traffic is

converted to the SIP signalling to adapt to the SIP trunks of ServiceBC infrastructure at MAXIMUS Canada. Once the end user i.e., a citizen/resident select an option for communicating on ServiceBC website the request is directed through the cafe-X solution where the Fusion web gateway helps in signalling conversion and Fusion Media Broker helps in providing the Media. The request is sent to the MAXIMUS contact center via SIP trunks and is placed to respective queue of ServiceBC agents.

Once the request is in the queue, and there is an available ServiceBC agent it is held for their acceptance. Once the agent accepts the request the confirmation is sent to the citizen and there is a communication link established between them over a secured network using the reverse proxy server.

1.3.1 Video Chat

Video chat is a feature which has been incorporated for ServiceBC at MAXIMUS Canada. With the help of this feature residents can virtually connect face-to-face with ServiceBC agents from anywhere to work through complex issues, queries and also validate their health cards remotely over a video call. It can be used by both Photo BC Services Card and Non-Photo BC Services Card holders. It is one-click HD voice and video calling with mobile apps and websites with frictionless transitions between residents and the ServiceBC agents. This feature will not only reduce the processing time but also allows the residents to use their health card immediately after they are validated by one of the ServiceBC agents over the video chat.

1.3.2 Web Chat:

Web chat is another feature which has been incorporated for ServiceBC at MAXIMUS Canada. This feature allows residents to connect with ServiceBC agents for quick and easy assistance with questions, services and share important documents/JPEG pictures for validation. Web chat feature will help in faster support, real-time text preview, instant customer feedback, low barrier, quicker resolutions, file/ photo transfer, collaborative support with other teams for multiple teams-oriented issues/ queries, increased efficiency and data security. It allows residents to request for a chat summary at the end of their chat to the agents for future reference. With the help of this feature, ServiceBC agents can assist multiple residents at once which helps in improving the productivity.

1.3.3 Co-Browse:

Co-browse is a tool which has been incorporated for ServiceBC at MAXIMUS Canada. It is used by ServiceBC agents to get access to citizens webpage upon their request which help them in assisting their queries and fill any health-related form by hiding sensitive information to the agents. It also allows ServiceBC agents to draw annotations, push files securely over the shared screen in real time to support residents effectively in seconds. Co-browsing session is usually initiated by the agent when a citizen requests it over a web chat, video chat or a phone call. Through this process, the

agent will send a security keyword upon initiation and once the citizen enters it on his co-browse page there is a session established and then agent will be able to view citizen's current page and navigate through it. With the help of this feature agents can easily understand citizen queries and resolve them in real-time. It also helps the citizens to fill their form remotely hence reducing the travel and processing times.

In order to incorporate these enhanced features into the existing contact center architecture of ServiceBC at MAXIMUS Canada, several factors need to be considered and tested for overall successful output. Below are the major steps which are followed during the project design, implementation and testing.

1. Current contact center architecture of ServiceBC [10] at MAXIMUS Canada [11] has been studied and understood in detail along with number of telecommunication/networking providers that provide real time communication solutions.
2. Amongst all studied providers Cafe-X platform has been chosen, as it needs a very small amount of server-side development. While some level of server-side code must be implemented to secure access to the communications services, this effort is minimal and limited to configuring a "session" using a REST API. The Cafe-X platform and API that has been built over the years is rich and, as of the latest release, is simple and optimized for enterprise consumption.
3. Cafe-X, by offering extensive suite of collaboration services directly from its highly secure cloud-based infrastructure, the platform provides convenient building blocks to enable enterprise-built applications with the communication capabilities by focusing on persistent and asynchronous collaboration alongside real-time communication capabilities.
4. Cafe-X does not provide routing solutions. Instead, the platform supports integrating these sessions with other routing and workforce management systems.
5. Services provided by Cafe-X include Voice for high-definition multiparty voice over IP and PSTN integration, Video for high-definition multi party video over IP, Screen Share for real time screen streaming to one or more viewers, Chat for one-to-one and one-to-many text-based chat, Doc Share for common shared view of documents. By integrating Cafe-X with current architecture at MAXIMUS Canada, all these services can be effectively utilized in obtaining enhanced features for ServiceBC.
6. Cafe-X solution is integrated with current contact center architecture of ServiceBC by considering all the factors such as networking infrastructure, site preparation, software compatibilities and the integrated system is monitored for any errors or issues. By addressing all the errors or issues the final non-defective solution is obtained.

7. After implementation, Business, Functional and Non-functional requirements are built based on the new features with the current ServiceBC call flows.
8. UML diagrams for all the three features showing the call flow from the point the call hits the queue to end of the call has been built and validated.
9. Test cases for all the features based on the UML diagrams has been built taking into consideration all possible ways the call may hit the queue and covering all possible agent states when it hits the queue.
10. Test and Dev environments for the overall integrated solution has been set up for testing all the business, functional and non-functional requirements.
11. Initial testing of each individual feature of the enhanced ServiceBC contact center has been tested with both options available on agent and end-user side.
12. After the individual feature testing is completed successfully without any defects, overall end to end testing of all the call flows involved in the enhanced contact center have been rigorously tested and monitored for any delays, echoes, blur of the screen, video and audio issues, connectivity issues along with the service provider side issues.
13. After overall unit has been tested successfully without any major/minor defects, application level testing involving test agent and resident has been performed of the entire unit has been done and detected for all the minor and major errors.
14. All the defects found during every level of testing are tracked using defect tracking process and addressed accordingly.
15. Re-testing of each unit along with the complete architecture testing has been performed in order to obtain a system with zero major and minimal minor issues along with warnings which can be ignored.
16. During the process of incorporating channel expansion features into the existing architecture, it should be understood that other units in the existing architecture such as recording, fax, other health care, monitoring, privacy/security, voice mail units and so on has to be tested in parallel to make sure that they are not impacted.

1.4 Project Organization:

- Chapter 1 is the introduction to this project, and provides a summary of the background of this project followed by motivation explaining the drawbacks involved with current modes of channels at MAXIMUS Canada contact center for ServiceBC and how they are addressed using enhanced modes of communication video chat, web chat and co-browse tool. This chapter also explains main steps which are followed in channel expansion for ServiceBC at MAXIMUS Canada.

- Chapter 2 provides a detailed description of Cafe-X solution architecture along with different modes of communication available for residents to reach ServiceBC agents at MAXIMUS Canada contact center before channel expansion followed by brief overview of Cafe-X integration with ServiceBC contact center at MAXIMUS Canada. Also, different modes of communication available for residents to reach ServiceBC agents at MAXIMUS Canada after integration is analyzed followed by detailed description of each enhanced feature video chat, web chat and co-browse using their respective UML diagram/ screenshots.
- Chapter 3 provides an overview of deployment, installation and configuration involved while incorporating Cafe-X components to existing MAXIMUS Canada contact center architecture
- Chapter 4 provides detailed testing approach followed in this project including exploratory testing, integration testing, functional testing and business acceptance testing followed by defect tracking process to log and address every defect found in each phase of testing. All the results of testing are shown with 1st cycle and final cycle with few defect tracking process screenshots for some defects. Screenshots explaining test video chat, web chat and co-browse tool are also shown.
- Chapter 5 states the conclusions drawn from this project work and suggests possible directions for future research.

Chapter 2: Integration of Cafe-X solution with MAXIMUS Canada Contact Center for ServiceBC

In this chapter, Cafe-X solution architecture along with different modes of communication available for residents to reach ServiceBC agents at MAXIMUS Canada contact center before channel expansion is explained in detail followed by brief overview of Cafe-X integration with ServiceBC contact center at MAXIMUS Canada. Also, different modes of communication available for residents to reach ServiceBC agents at MAXIMUS Canada after integration is analyzed followed by detailed description of each enhanced feature video chat, web chat and co-browse using their respective UML diagram/ screenshots. This chapter concludes by providing an overview of how the enhanced features are implemented, what major components of Cafe-X solution supports in obtaining these features, how are they useful for end users.

2.1 Cafe-X Solution:

This section provides an overview of Cafe-X solution architecture along with detailed description of major components involved in it such as Fusion Application server, Fusion client SDK, Fusion web gateway, Media Broker, Fusion Live assist, Live assist server, Customer service and Agent service which supports in obtaining the enhanced features video chat, web chat and co-browsing.

2.1.1 Introduction

Cafe-X is a leading provider of enterprise software for enabling mobile applications and websites with real time collaboration (including video chat, co-browsing, on-screen drawing, and other Live Assist features) to increase customer satisfaction and enterprise efficiency [15]. Cafe-X SDKs enable context rich real-time communications within existing applications. The Cafe-X Communications Fusion Client SDK allows users to develop web applications which can:

1. Make and receive voice and video calls directly from a Web browser to telephones and other browsers, without employing web plugins.
2. Share application events and data

Fusion Client SDK includes components which allow the enterprise to deploy the applications which they develop:

1. The Fusion Web Gateway, which normalizes the signaling between SIP [18] - based devices and applications, so that the two can communicate together seamlessly.
2. The Fusion Media Broker, which converts between browser-originated RTP [19] streams and RTP streams compatible with SIP entities.

2.1.2 Architecture

Cafe-X architecture consists of different components such as Fusion Media Broker, Fusion Gateway, Live assist, Web App, Fusion Application Server, Fusion client SDKs, Live assist server, customer service, agent service and SIP domain involved in communication. Figure 6 shows different protocols involved in communication among all the components of Cafe-X architecture along with client interface and SIP domain.

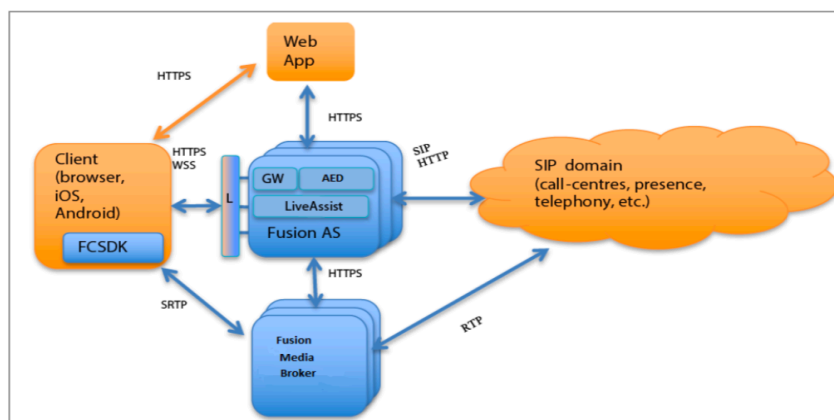


Figure 6: Cafe-X Architecture and its components

2.1.2.1 Fusion Application Server

The **Fusion Application Server (FAS)** is the base platform on which the **Fusion Web Gateway** and **Live Assist** components are installed. FAS is a combined SIP and HTTP application platform. It consists of:

1. The Application Server (AS), where service applications run. There may be several AS nodes in a cluster. The application which run on the AS may be:
 - a) The WebRTC/SIP Gateway, which handles calls between WebRTC [20] and SIP telephony clients
 - b) Live Assist, which integrates co-browsing with WebRTC telephony
 - c) AED, for inter-application communication
2. The Load Balancer (LB), the outward facing component of a High Availability cluster. It receives SIP and HTTP messages and sends them to the correct AS node for processing.

2.1.2.2 Fusion Client SDK

Two main components of Fusion Client SDK (FCSDK) are the JavaScript files and the Web Gateway. When included in a web page, the JavaScript enables the page to connect to the Gateway (using a Web Socket interface), and to send and receive messages from it. The Gateway interfaces with a SIP domain, either locally or via an outbound proxy, and translates WebRTC messages to SIP and SIP messages to WebRTC. It further integrates in the background with the Media Broker using a REST interface.

Applications developed with FCSDK can integrate multiple modes of enterprise communication:

1. **Voice and video calling**
FCSDK enables users to make calls to other audio or video devices in the network, for example: PBXs [21], Conference bridges and other **Fusion Client SDK** clients.
2. **Application Event Distribution**
FCSDK can share data and synchronize state on multiple clients, presenting each client with the same experience.

2.1.2.3 Web Gateway

The Web Gateway runs on the AS, and removes the complexity in the signaling between SIP-based devices and client applications, so that the two can communicate together seamlessly. It communicates with the client using the TCP [22]-based Web Sockets protocol, providing a standardized way for the server to send content to the client without being solicited, and allowing for messages to be passed back and forth while keeping the connection open. If required, a highly available HA solution can be constructed by using multiple Web Gateways to form a single cluster.

2.1.2.4 Media Broker

The Media Broker runs independently of this cluster (that is, it does not run on FAS) and is responsible for media transcoding and RTP [19] routing between the client applications and the SIP network. Routing is configured based on the SDP [23] passing through the Web Gateway. For communication into the enterprise, its role is to simplify the RTP, limiting it to a form that is supported by the users' devices. For communication going to the client application, it augments the RTP with the WebRTC-compliant features that are required.

2.1.2.5 Fusion Live Assist

Fusion Client SDK is enhanced by Fusion Live Assist. When a web or mobile application includes Live Assist, its proprietary technology enables an enterprise user to see an online visitor's screen, temporarily take control to navigate for them, draw on their screen using a simple pen tool, and push links, pictures and documents from a relevant knowledge base.

Live Assist consists of the following core server-side components:

1. Live Assist Server
2. Consumer Service
3. Agent Service
4. Live Assist Consumer SDKs (Web, iOS, and Android)
5. Live Assist Agent Console SDK (Web)

Live Assist requires the Web Gateway primarily for Session Token management and for voice and video support, where applicable.

2.1.2.6 Live Assist Server

The Live Assist server is the central point which consumers and agents connect to when sharing content in co-browsing sessions. A consumer and an agent share the same co-browsing session, identified by a correlation ID, so that the Live Assist server can pass the data received from one to the other.

2.1.2.7 Consumer Service

For a consumer to use Live Assist, they must have a session token, which is specific to that consumer. By default, the Live Assist SDKs create a session token using the integrated Consumer Service. The Consumer Service creates session tokens on behalf of the consumer, and returns those tokens to the application on the consumer's device. The session token also controls the functionality and capabilities that the consumer can access.

2.1.2.8 Agent Service

An agent also requires a session token to use Live Assist. The Agent Service creates session tokens for each agent using the Live Assist SDK. While a consumer session token is limited to only making outbound calls, an agent session token is limited to only receiving inbound calls.

2.2 Modes of Communication at MAXIMUS Canada Contact Center before Channel Expansion:

Currently, contact center at MAXIMUS Canada for ServiceBC supports three mode of channels Phone, Email and SMS for its residents as shown in Figure 7. Residents have an option to click on any of these three modes of communication on ServiceBC webpage to connect with available agent in the queue for any of their ServiceBC related queries.

When resident clicks on the link over the webpage it will direct to the MAXIMUS contact center and will be routed through respective queue. By using these three channels, it will limit residents to validate their health cards and share any health-related forms with the agents in real time. Also, they have to visit their nearby ServiceBC office in order to have face-to-face assistance with the agents which will increase the processing times and causes delay in obtaining their health services.

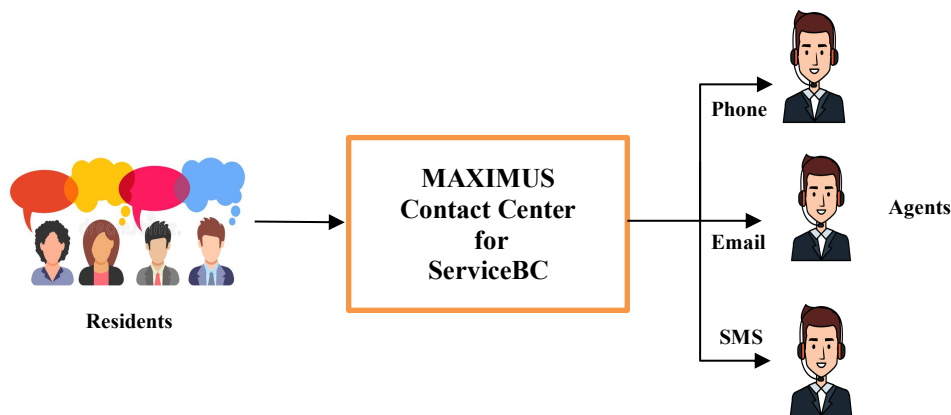


Figure 7: Channels supported by MAXIMUS Canada contact center before channel expansion

In Figure 8, UML diagram for modes of communication available at contact center at MAXIMUS Canada before channel expansion is shown. As depicted, citizen have an option to choose any of the modes of communication to contact ServiceBC agent at MAXIMUS Canada. Once a channel is selected, the request is sent to respective queue and it will be addressed by next available agent in the queue. If no agents are available in queue, based on the business hours the request will be sent to voice mail system.

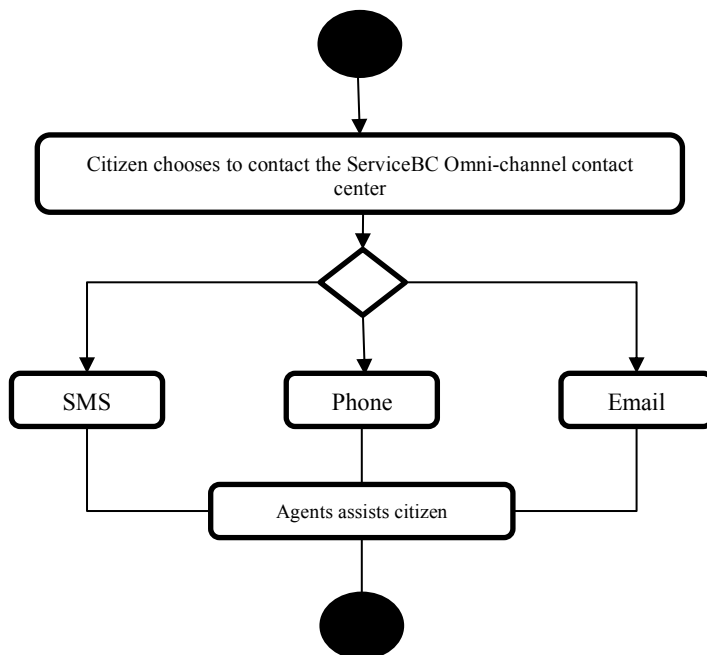


Figure 8: UML diagram showing modes of channels at MAXIMUS Canada before channel expansion

2.3 Integration of Cafe-X Solution with MAXIMUS Canada Contact Center for ServiceBC:

In this section, incorporation of Cafe-X components to MAXIMUS Canada contact center is analyzed by explaining each network component of Cafe-X solution on how it helps in obtaining enhanced features video chat, web chat and co-browse tool. Also, the functions involved with each component is summarized which supports in obtaining these enhanced functionalities. An overview of integration of Cafe-X solution with MAXIMUS Canada contact center for ServiceBC involving citizens and ServiceBC agents as end users involving the major network components of Cafe-X is shown in Figure 9.

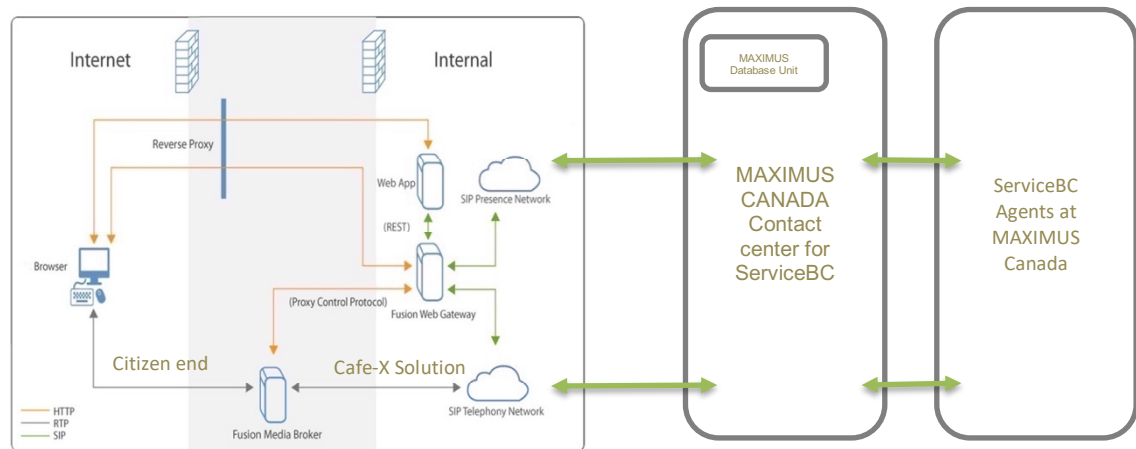


Figure 9: Integration of Cafe-X with MAXIMUS Canada Contact center

Below are few major features which needs to be incorporated through the integration process of Cafe-X with MAXIMUS Canada,

1. The **WebRTC/SIP Gateway**, which handles calls between WebRTC and SIP telephony clients.
2. **Live Assist**, which integrates co-browsing with WebRTC telephony.
3. **AED (Application event Distribution)** publish and subscribe messaging service, for inter-application communication.
4. **JavaScript files** that enables the page to connect to the Gateway (using a WebSocket interface), and to send and receive messages from it.
5. **Web Gateway** that interfaces with a SIP domain, either locally or via an outbound proxy, and translates WebRTC messages to SIP and SIP messages to WebRTC.
6. **Media Broker** that runs independently and is responsible for media transcoding and RTP routing between the client applications and the SIP network.
7. **Live Assist** feature, when a web or mobile application includes Live Assist, its proprietary technology enables an enterprise user to see an online visitor's screen,

- temporarily take control to navigate for them, draw on their screen using a simple pen tool, and push links, pictures and documents from a relevant knowledge base.
8. Live Assist server which is the central point through which consumers and agents connect to when sharing content in co-browsing sessions.
 9. The **Live Assist** consumer SDKs that provides simple APIs for application developers to use, so that with only a few lines of code they can integrate Live Assist into a new or existing application.
 10. The **Live Assist Agent Console SDK** that enables a developer to integrate the Live Assist functionality into a bespoke or pre-existing Agent Console.

As seen in above Figure 9, the Fusion Web gateway helps in removing signaling complexity between client app and SIP endpoints and plays a major role in signalling conversions. Fusion Media Broker is another important network component of Cafe-X which helps in converts and adapts media between external clients and enterprise devices; for inbound traffic, simplifies & limits RTP for legacy devices; for outbound traffic adds additional features for browser & mobile clients. With the help of Fusion Web gateway, the incoming HTTP traffic is converted to the SIP signalling to adapt to the SIP trunks of ServiceBC infrastructure at MAXIMUS Canada. Once the end user i.e., a citizen/resident select an option for communicating on ServiceBC website the request is directed through the Cafe-X solution where the Fusion web gateway helps in signalling conversion and Fusion Media Broker helps in providing the Media. The request is sent to the MAXIMUS contact center via SIP trunks and is placed to respective queue of ServiceBC agents.

Once the request is in the queue, and there is an available ServiceBC agent it is held for their acceptance. Once the agent accepts the request the confirmation is sent to the citizen and there is a communication link established between them over a secured network using the reverse proxy server. Table 2 below provides a detailed description of each Network component involved along with their respective functionalities and dependencies.

Table 2: Network components involved in channel expansion

Component	Description	Function(s)	Dependencies
Fusion Client SDK	Enhances client applications with voice, video, IM, presence & application event distribution sessions	<p>Uses WebRTC to expose voice/video within browsers (smartphone libraries follow WebRTC spec for consistency)</p> <p>Integrates with Cisco Jabber & Microsoft Lync IM/presence systems</p> <p>Application event distribution with shared control and no ball passing</p> <p>Provides platform specific (iOS, Android,</p>	<p>Mobile: iOS, Android</p> <p>Browser: Chrome (28+) Firefox (26+)</p> <p>Opera (18+)</p> <p>Safari (7.0+ w/ plugin)</p> <p>IE (8,9,10,11 w/ plugin)</p>

		JavaScript) libraries	32/64 bit)
Client (Customer Provided)	Mobile or browser user interface	Provide user interaction with web app Present collaboration capabilities to user via the Fusion Client SDK and interaction with Fusion components	Security: HTTP(S) & SRTP
Web Application (Customer Provided)	New or existing web application enabled with collaboration capabilities via Fusion Client SDK	Authenticate users and determine which services should be available to them Create and end sessions on Fusion Web Gateway Provide UI content to client	Amended to communicate with Fusion Web Gateway to start/stop sessions
Reverse Proxy Server (Customer)	Ensures network security for external devices	Retrieve resources from Fusion Web Gateway on behalf of client application	WebSockets support Resides in DMZ for external clients
Fusion Web Gateway	Removes signaling complexity between client app and SIP endpoints Provides SIP interoperability across enterprise	HTTP to SIP signaling conversion Control session creation by clients Rely on HTTP for control channels enabling security through firewall, reverse proxy, etc. Create and manage sessions for voice/video, IM & presence and application event distribution Communicate with client application using WebSockets protocol Normalize SIP signaling across enterprise Normalize SIP for Instant Messaging & Presence Extensions (SIMPLE) for processing by UC presence platform	Runs on Fusion Application Server (FAS) 2.0 which requires load balancer Cisco presence proxy runs on FAS 2.0, (Linux & Windows) Msft presence proxy runs on FAS 2.0 (Windows only) DNS resolvable
Fusion Media Broker	Converts and adapts media between external clients and enterprise devices; for inbound traffic, simplifies & limits RTP for legacy devices; for outbound traffic adds additional features for browser & mobile clients	Convert between client app SRTP and SIP compatible RTP streams Translate SDP for enterprise use Audio & video transcoding Network impairment handling (NACK/PLI) Adaptive rate control (REMB/TMMBR) Load balancing (CPU) SRTP termination point STUN termination point Media port multiplexing	RTP routes based on SDP passing through Fusion Web Gateway Resides in DMZ Video transcoding requires separate VM (VMware 5.0+) Video calls require 1Mbps up/down, audio ~100Kbps

As shown in Table 1, all the components involved in the integration supports for the new functionalities video chat, web chat and co-browse. With the help of these enhanced channels, residents will be able to easily approach ServiceBC agents for their queries and quickly validate their health cards (MSP) without any delays virtually over a video chat with an available agent, fill ServiceBC health related forms, submit documents as part of verification, add additional information on to their profile, share their screen to a ServiceBC agent and so on.

2.4 Modes of Communication at MAXIMUS Canada contact center after channel expansion:

After integration, three new modes of channels video chat, web chat and co-browse tool are added to the ServiceBC contact center at MAXIMUS Canada along with the existing channels as shown in Figure 10. Residents will now have an option of choosing these enhanced features along with the existing ones to connect with ServiceBC agents.

Once a resident selects any of the channels available, the request will be directed to respective queue and will be addressed once the agent is available. If an agent is not available, based on the business hours the request is sent to voice mail system. These enhanced features will allow all the photo and non-photo BC residents to connect with ServiceBC agents face-to-face virtually to validate their health cards and fill any of the health-related forms in real time. This also allows agent to assist resident's query more precisely and quickly. Residents have an option of initiating a co-browse session if needed through any of the channels to share their screen with the ServiceBC agents to assist them in filling forms and understand their queries.

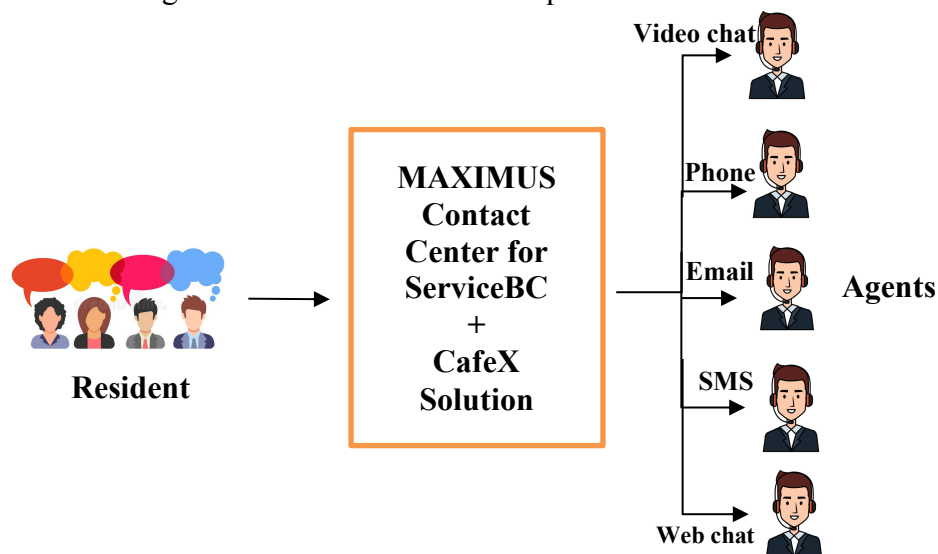


Figure 10: Channels supported by MAXIMUS Canada contact center after channel expansion

In Figure 11, UML diagram for modes of communication available at contact center at MAXIMUS Canada after channel expansion is shown. As depicted, citizen have an option to choose any of the modes of communication to contact ServiceBC agent at MAXIMUS Canada. Once a channel is selected, the request is sent to respective queue and it will be addressed by next available agent in the queue. If no agents are available in queue, based on the business hours the request will be sent to voice mail system.

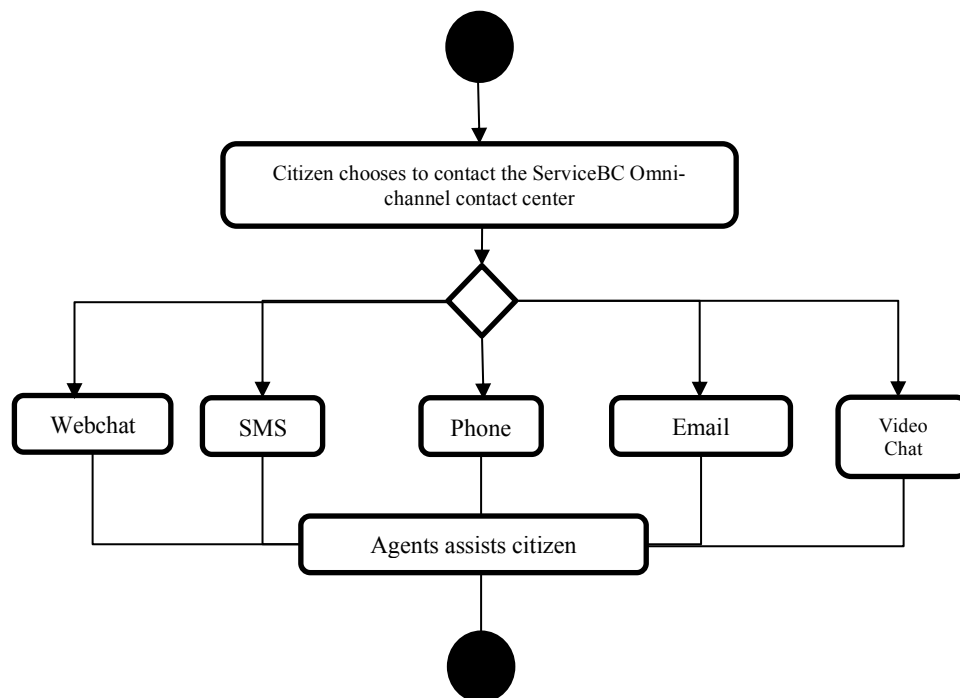


Figure 11: UML diagram showing modes of channels at MAXIMUS Canada after channel Expansion

2.4.1 Video Chat

Video chat is one of the enhanced features which are integrated to the existing MAXIMUS Canada contact center for ServiceBC. This feature can be initiated by any of the eligible BC residents from ServiceBC website or mobile application to have a virtual face-to-face interaction with agents which allows them to better explain their queries and quicker resolution. Figure 12 gives an overall call flow which takes place through the application when a video chat is initiated from resident.

The step by step process involved when a video chat is initiated is as below,

1. Once a video chat is initiated by an individual by clicking on the video chat option on ServiceBC website, the request is sent to video chat queue of contact center at MAXIMUS Canada.
2. After the call is in queue, it always verifies whether any agent is signed-in and is available to take the video chat or not.
3. If there is no agent signed it, a technical difficulty message will be played to the caller and the call is disconnected.
4. If there is an agent signed-in, then the system checks for agent's availability.

5. If the agent is signed in and not available, the system checks for “End of day” or not.
6. If agent is signed in, not available and it is not the “End of the day” the caller/citizen/resident is placed back in the queue till the next agent is available.
7. If the agent is signed in, not available and it is “End of the day” then office closed message is played and call gets disconnected.
8. If agent is signed in and available then the video chat request is received by the agents skilled on video chat.
9. Once the ServiceBC agent receives the video chat request, it is accepted.
10. If the connection between the agent and the citizen/resident is not successful, the call is sent to error handling unit to check for any connectivity issues during the video chat and the call is disconnected. For this to happen, error handling needs to be enabled.
11. If the connection between the agent and the citizen/resident is successful, the agent and citizen will be able to talk and see each other.
12. Once the agent is connected to the citizen/residents he opens the parameterized information for validation of the health card using either photo or non-photo identification.
13. During the process of conversation with the agent, citizen will have an option to check if additional channel is required like co-browse/web chat/text.
14. If additional channel is required, the call is directed to multi-channel assist unit where they have an option of selecting another channel according.
15. If no additional is required, citizen has also an option of checking if escalation is required in the call.
16. If escalation is required in the call by the citizen, then the call is directed to either the supervisor or other higher authorities and it is disconnected accordingly.
17. If no escalation is needed, then agent will be able to assist with all citizen’s queries.
18. If all the queries are addressed, the call is disconnected.
19. After the call is disconnected, citizen/residents are directed to post-call interaction survey where they are asked few questions related to their recent call. These responses are useful to improve the call qualities, agent’s ratings and so on.

In this process, Fusion web gateway of Cafe-X solution provides signalling conversion and Fusion Media server is responsible for the RTP. With the help of this feature residents can virtually connect face-to-face with ServiceBC agents to work through complex issues, queries and also validate their health cards remotely over a video call. It can be used by both Photo BC Services Card and Non-Photo BC Services card holders. This feature will not only reduce the processing time but also allows the residents to use their health card immediately after they are validated by one of the ServiceBC agents over the video chat.

In this project, the infrastructure is built in such a way that one ServiceBC agent can address one video chat at any given point of time along with maximum of three web chats, three texts and multiple emails upon requirement. This can be increased further in future development by increasing the infrastructure accordingly.

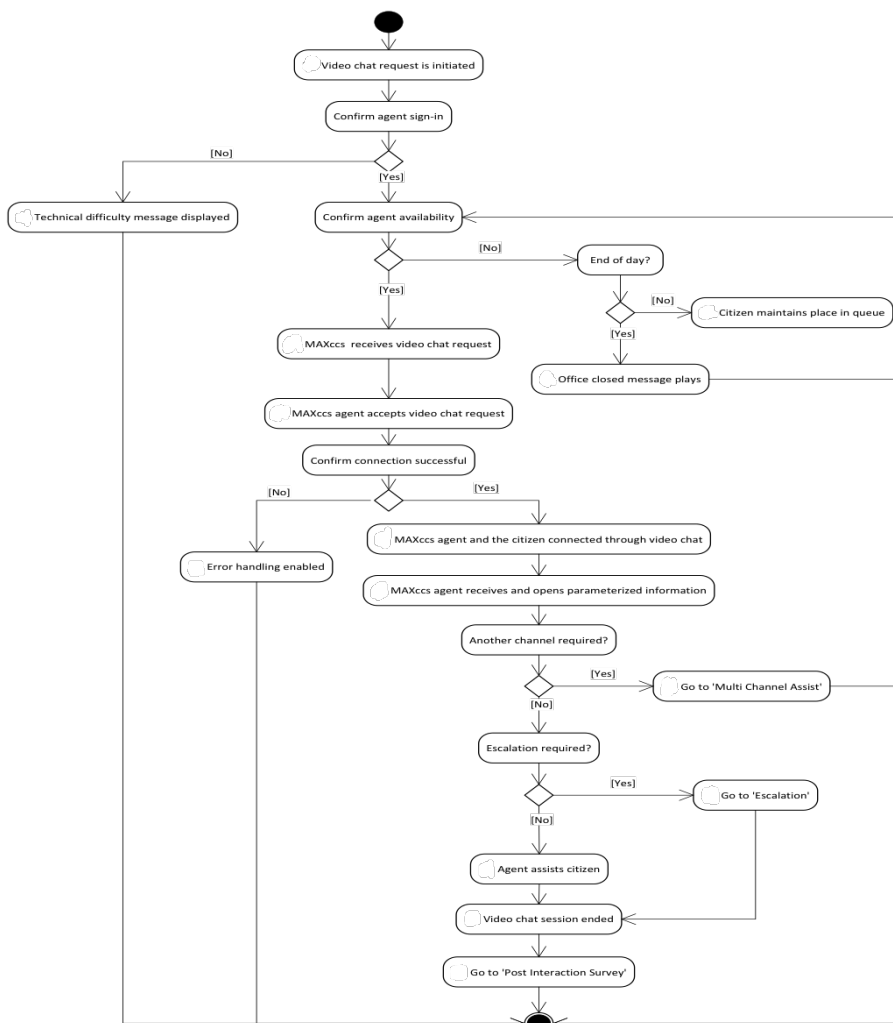


Figure 12: UML diagram of Video Chat call flow when initiated

2.4.2 Identity Verification Process through Video chat

Identity verification process is used to validate the residents/citizens health cards through video chat for all photo and non-photo BC residents. With the help of this process BC residents will be able to validate their health cards remotely over a video call without actually visiting the ServiceBC office which can save time and they will be able to use their health cards immediately without any delays.

This process is initiated once a video chat is initiated for all photo and non-photo BC residents as shown in Figure 13. Agent will have access to the ID Check website through which the caller data is displayed. BC residents are requested to provide a valid photo or non-photo identity along with required information for verification of their health cards. The step by step process of Identity verification process through video chat is shown below,

1. Once the citizen/residents initiate the video chat, the request will process through all the steps detailed in video chat call flow till step 12.

2. Once the connection between the agent and the resident/citizen is established, citizens identity information is displayed to the agent through the ID check website.
3. Once the identity information is displayed to the agent, agent will be checking for whether the document is photo or non-photo ID.
4. If a non-photo ID is provided, agent requests for additional documents from the resident/citizen in order to verify their identity.
5. If additional document is not provided by the citizen, agent sends a denial indicator along with a note in citizen's account.
6. After the denial note is sent, citizen has an option of requesting for escalation. If escalation is not required, video chat is ended.
7. If escalation is requested, the call is transferred to respective supervisor or higher authorities.
8. If the additional document provided by the citizen along with non-photo ID, then agent checks if the additional document satisfies the requirement for verification or not.
9. If the additional document provided along with non-photo ID is not satisfied by the agent, a denial indicator is sent to the citizen along with a not in citizen's account.
10. After the denial note is sent, citizen has an option of requesting for escalation. If escalation is not required, video chat is ended.
11. If escalation is requested, the call is transferred to respective supervisor or higher authorities.
12. If the additional document provided by the citizen along with non-photo ID satisfies the agent, a verification indicator is sent to the citizen.
13. If the citizen requests for escalation, call is transferred to escalation otherwise the video chat is disconnected.
14. If the initial document provided by the citizen is the photo ID, then agent checks if it satisfies the requirement or not.
15. If the document does not satisfy the requirement, a denial indicator is sent to the citizen along with note in citizen's account and steps 6 and 7 are done.
16. If the photo ID provided by the citizen satisfies the requirement, agent sends a verification indicator to the citizen.
17. If the citizen requests for escalation, call is transferred to escalation otherwise the video chat is disconnected.

During this process, Fusion web gateway of Café-X solution provides signalling conversion and Fusion Media server is responsible for the RTP and if agents can not verify the caller's identity due to poor connection or not having enough identity proofs, residents are advised to visit the nearby ServiceBC office for further verification and process.

In this project, the infrastructure is built in such a way that one ServiceBC agent can address one video chat with one ID check process at any given point of time along with maximum of three web chats, three texts and multiple emails upon requirement. This can be increased further in future development by increasing the infrastructure accordingly.

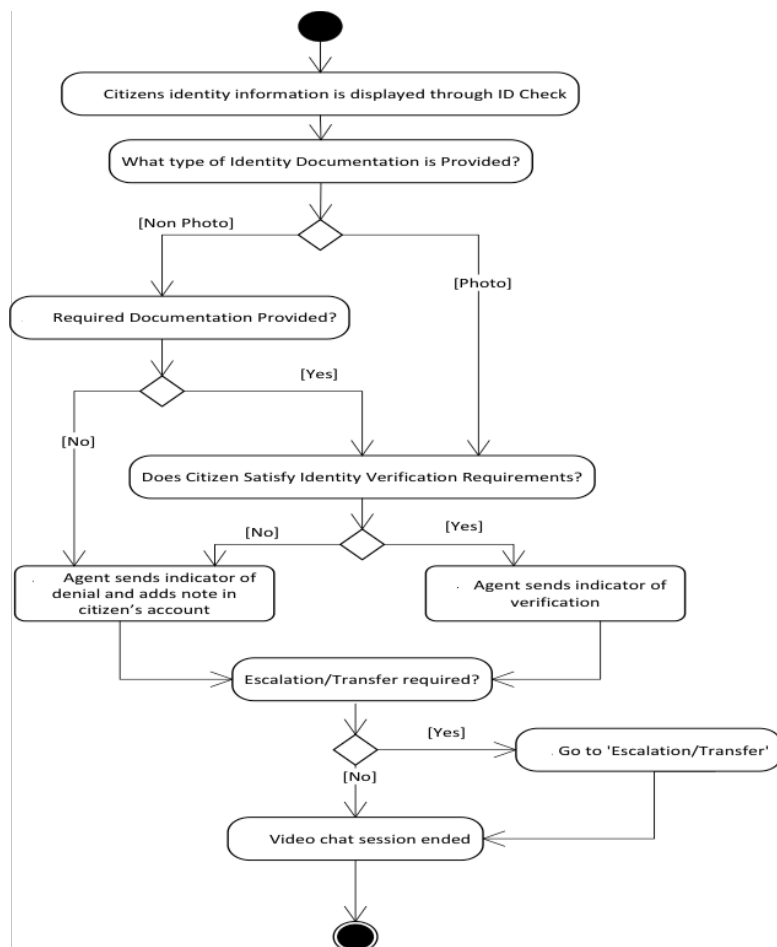


Figure 13: Identity Verification Process through Video chat

2.4.3 Web Chat

Web chat is one of the enhanced features which are integrated to the existing MAXIMUS Canada contact center for ServiceBC. This feature can be initiated by any of the eligible BC residents from ServiceBC website or mobile application to have a web conversation with agents which allows them to share any documents/pictures, have track of all their texts to better explain their queries and faster resolution. Figure 14 gives an overall call flow which takes place through the application when a web chat is initiated from resident.

The step by step process involved when a video chat is initiated is as below,

1. Once a web chat is initiated by an individual by clicking on the web chat option on ServiceBC website, the request is sent to web chat queue of contact center at MAXIMUS Canada.
2. After the chat is in queue, it always verifies whether any agent is signed-in and is available to take the web chat or not.
3. If there is no agent signed it, a technical difficulty message will be played to the caller and the chat is disconnected.

4. If there is an agent signed-in, then the system checks for agent's availability.
5. If the agent is signed in and not available, the system checks for "End of day" or not.
6. If agent is signed in, not available and it is not the "End of the day" the caller/citizen/resident is placed back in the queue till the next agent is available.
7. If the agent is signed in, not available and it is "End of the day" then office closed message is played and chat gets disconnected.
8. If agent is signed in and available then the web chat request is received by the agents skilled on web chat.
9. Once the ServiceBC agent receives the web chat request, it is accepted.
10. If the connection between the agent and the citizen/resident is not successful, the web chat is sent to error handling unit to check for any connectivity issues during the web chat and the chat is disconnected. For this to happen, error handling needs to be enabled.
11. If the connection between the agent and the citizen/resident is successful, the agent and citizen will be able to chat with each other.
12. During the process of conversation with the agent, citizen will have an option to check if additional channel is required like co-browse/video chat/text.
13. If additional channel is required, the chat is directed to multi-channel assist unit where they have an option of selecting another channel according.
14. If no additional is required, citizen has also an option of checking if escalation is required in the chat.
15. If escalation is required in the chat by the citizen, then the chat is directed to either the supervisor or other higher authorities and it is disconnected accordingly.
16. If no escalation is needed, then agent will be able to assist with all citizen's queries.
17. If all the queries are addressed, the chat is disconnected.
18. After the chat is disconnected, citizen/residents are directed to post interaction survey where they are asked few questions related to their recent chat. These responses are useful to improve the chat qualities, agent's ratings and so on.

In this process, Fusion web gateway of Cafe-X solution provides signalling conversion and Fusion Media server is responsible for the RTP. Web chat feature allows residents to connect with ServiceBC agents for quick and easy assistance with questions, services and share important documents/JPEG pictures for validation. Web chat feature will help in faster support, real-time text preview, instant customer feedback, low barrier, quicker resolutions, file/ photo transfer, collaborative support with other teams for multiple teams-oriented issues/ queries, increased efficiency and data security. It allows residents to request for a chat summary at the end of their chat to the agents for future reference. With the help of this feature, ServiceBC agents can assist multiple residents at once which helps in improving the productivity.

In this project, the infrastructure is built in such a way that one ServiceBC agent can address three web chats at any given point of time along with maximum of one video chat, three texts and multiple emails upon requirement. This can be increased further in future development by increasing the infrastructure accordingly.

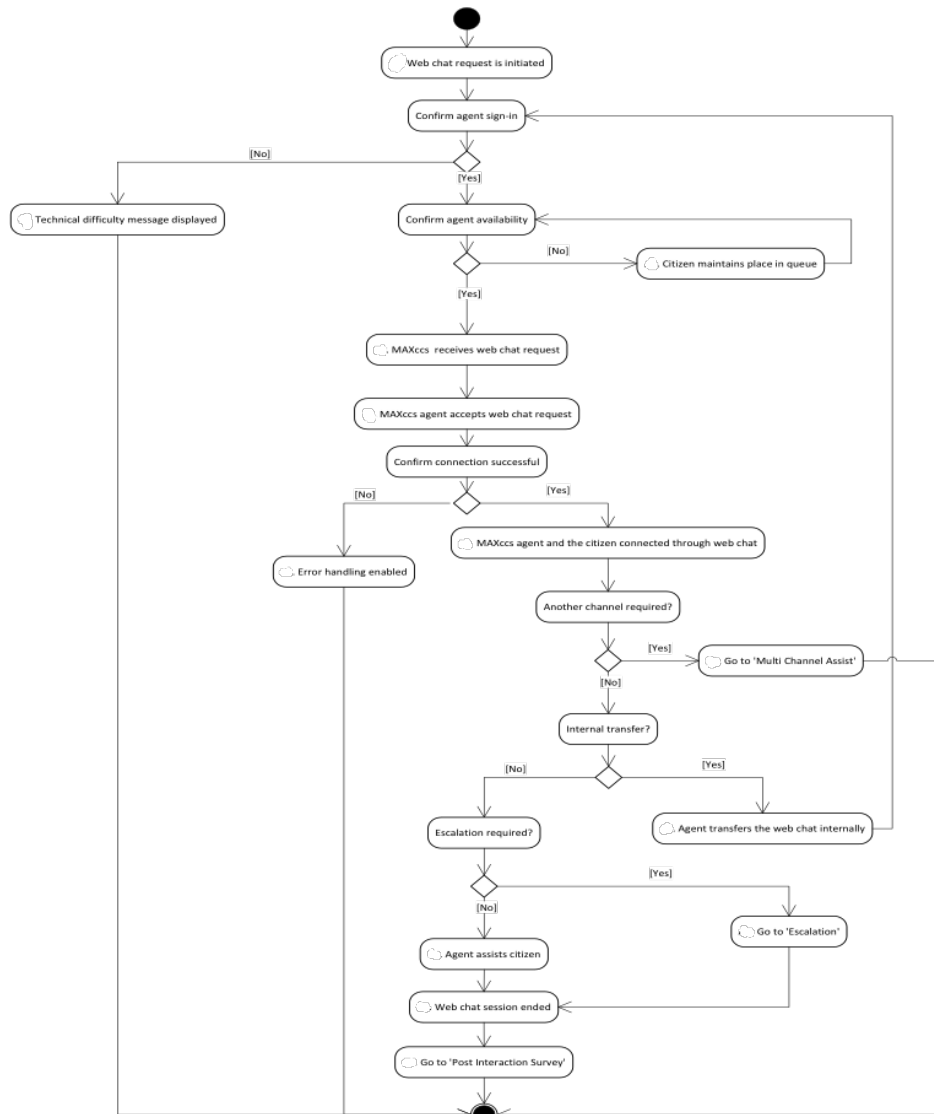


Figure 14: UML diagram showing Web Chat flow when initiated

2.4.4 Co-Browse Tool

Collaborative browsing (also known as co-browsing) is a software-enabled technique that allows a citizen to request a contact center agent’s assistance for securely sharing their web page, in real-time. In order to have a co-browse session, citizen should be either on live video call, web chat, text, phone or email with the agent. Once the citizen requests for a co-browse session, a short code is popped up to the citizen. Once the agent enters this short code provided by the citizen over the phone, video call, web chat, text or email on the “Live assist” tab on their agent’s console window, agent will be able to see the citizen’s screen and have access to their current page. Below are the co-browse options available for Agents and the Citizens when on a live co-browse session with one another,

1. “Select Mode” is available for both Agents and Citizens to select on the shared screen.

2. “Spotlight Mode” is available for both Agents and Citizens to point to anything on the shared screen while assisting.
3. “Draw Mode” is available for both Agents and Citizens to draw and show on the shared screen while assisting.
4. “Remove Annotations” to clear all the annotations done by the agent/citizen on shared screen.
5. “Push” option is available to the Agents to push all the available documents/links to the citizen.
6. When any “Links” are pushed to the citizen, the citizen screen is redirected to that link and co-browse session is suspended for the agent until the citizen comes back to the original webpage.
7. When any document is pushed to the Citizen, it will be displayed for both citizen and agent with below options available:
 - a. Close the document
 - b. Changing the position of the document
 - c. Resizing of the document
 - d. Maximizing and minimizing the content of the document along with the percentage
 - e. Scrolling the document
8. “Form Editor” is available for both Agents and Citizens in filling out the forms over co-browse session.
9. “Open zoom window” option is available for both agent and citizens in order to zoom specific content on the webpage to citizen while assisting. Below options are available for the zoom window:
 - a. Close the zoom window
 - b. Maximizing and minimizing the content of the zoom window along with the percentage
 - c. Resize the zoom window
 - d. Change the position of the zoom window
10. “Shrink co-browse screen” option to shrink the shared screen on the agent’s side.
11. “Expand co-browse screen” option to expand the shared screen on the agent’s side to default.
12. “Scroll up” and “Scroll down” is available for both Agents and Citizens to navigate up and down on the shared screen.
13. “Page up” option is available for both Agents and Citizens to navigate to top of the screen shared.
14. “Leave co-browse” option is available for both Agents and Citizens to leave the current co-browse session.
15. “Re-join co-browse” option is available for the agent to re-join the previous co-browse session if it is still active on the citizen’s side.

In this project, the infrastructure is built in such a way that one ServiceBC agent can address only one co-browse session at any given point of time along with maximum of one video chat/phone, three texts, three webchats and multiple emails upon requirement. This can be increased further in future development by increasing the infrastructure accordingly. Figure 15 provides a screenshot of Agent’s Finesse desktop showing a live co-browse session with the citizen where agent is able to see and access citizen’s screen.

It also shows that all the options mentioned above are available on the agent's screen while assisting through the session.

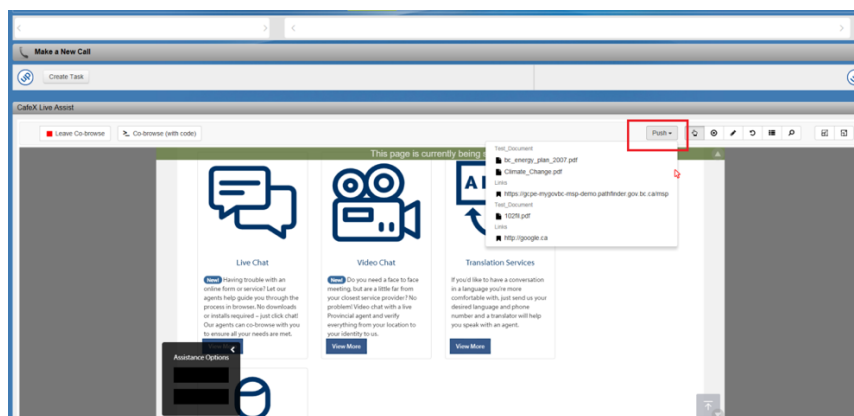


Figure 15: Agent's Finesse Desktop showing test co-browse session between agent and citizen

From this Chapter, we can conclude that with the help of current modes of communication phone, text, email for ServiceBC contact center at MAXIMUS Canada there are many drawbacks which have been observed such as BC residents had to visit there nearby ServiceBC office to activate there new MSP cards which may be a challenge for those living in remote locations and who may not be able to travel easily, there can be delay in processing times and challenge of not receiving the health benefits until BC residents visit ServiceBC office to activate there health cards, Residents may have difficulty in explaining their queries on phone/text/email to ServiceBC agents such as virtually asking about the form details they are filling or details which they are seeing on the website etc..., Residents will not be able to share any details to agents like images, files on phone/text/email leading them to manually visit ServiceBC office every time they need to.

With the help of enhanced modes of communication video, web and co-browse obtained by incorporating Cafe-X components in existing architecture of ServiceBC contact center at MAXIMUS Canada, these drawbacks can be addressed by allowing BC residents to better communicate with ServiceBC agents regarding there queries and also allow them to virtually validate their health cards hence reducing delay in receiving health benefits.

Chapter 3: Overview of Deployment, Installation and Configuration of Channel Expansion

In this chapter, an overview of deployment, installation and configuration involved while integrating Cafe-X solution to existing MAXIMUS Canada contact center architecture are discussed followed by system monitoring. This chapter concludes with a brief description of what has been done through deployment, installation and configuration phases followed by what has been achieved from these phases.

3.1 Channel Expansion deployment:

In this section, deployment planning, OS and Media broker requirements along with network infrastructure required in order to integrate Cafe-X solution with existing contact center architecture is discussed briefly.

3.1.1 Deployment Planning

As part of deployment planning, the existing contact center architecture at MAXIMUS Canada has been analyzed in detail and the scope of integrating Cafe-X solution to this system has been reviewed. The complete infrastructure currently available at MAXIMUS Canada has been reviewed in collaboration with infrastructure team to understand the scope of incorporating new channels to the existing infrastructure and understanding the limitation involved with each channel. In here, the infrastructure aspects include number of SIP trunks available to allocate for new incoming channels, recording storage available through Work force management application, software space available for installing new software and having backup space available, reporting infrastructure available for new channels, security and privacy concerns involved with new software and so on.

Below are four different phases involved in project deployment to understand the scope, implementation and execution without any major issues/concerns,

1. Site Preparation and Readiness

In this project, initially the complete technical implementation review of the existing architecture at MAXIMUS Canada along with site survey of both west (main server) and east (standby server) regions has been conducted. Each and every component involved with contact center architecture for ServiceBC has been analyzed to understand available capacities of each component to incorporate new features. Current database for ServiceBC contact center is examined to make sure it has enough connection space to have new features to avoid any crashes.

The call and screen recording unit has been examined to understand if new features can be incorporated without any overloads. Along with networking and database

infrastructure the site's agent capacity has been analyzed through reporting logs on how many average numbers of calls/texts/emails an agent is addressing currently to understand the capacity for new features. Based on all these surveys all the additional resources required has been assessed for the host and site environment. Additional agents are also been trained in order to take incoming ServiceBC queries from residents.

2. Software Installation

After site preparation, this step is one of the most crucial steps involved in deployment process as it involves initial analysis of complete architecture and components involved in it. During this process, all the versions of the components needs to be noted before integrating new components as it is highly important that there are no compatibility issues. Once the compatibility check is done and necessary environment is available, all the required components which needs to be integrated to the existing architecture such as Fusion Application Server, Fusion Web Gateway, Fusion Media Broker, general test applications/tools, Live Assist have been installed as per manual on both main and standby servers of MAXIMUS Canada contact center.

ServiceBC is responsible for delivering all health-related information and services to its residents as a result of which any delays in calls, loss of information, security concerns, audio and video disturbances, quality of the support are considered to be major concerns, so it is always recommended to have a standby unit along with the main unit. Load balancing over the trunks during higher call volumes can be addressed by diverting the calls to less utilized SIP trunks, this will avoid any delays or disturbances in audio and video qualities as they are the most important aspects for video chat, web chat and co-browse tool.

3. Interoperability, Test, and Use Case Verification

After installation and configuration, all the business, functional and non-functional requirements are built based on the enhanced features followed by use case diagrams for each feature video chat, web chat and co-browse based on the integrated architecture. After building use case flows for each channel, test cases are built for each and every call flow involved in the use case. The end solution is tested by following below objectives to ensure that after Cafe-X components are interoperated with the existing infrastructure of ServiceBC at MAXIMUS Canada contact center, all the extended channels such as video chat, web chat and co-browse are working as expected without affecting other components of the existing architecture,

1. Provide the details on the testing as part of Test Strategy.
2. Identify the specific business scenarios, call flows, message sets and non-functional requirements that require testing for the Video Chat, Web Chat channels and Co-Browse functionality.
3. Identify the test resources required to accomplish the testing.
4. Ensure that integration with Cafe-X solution does not affect the current architecture at MAXIMUS Canada.

The secondary objective of testing will be to:

1. Identify and expose all issues and associated risks.
2. Ensure all issues are addressed appropriately before release.

4. Handover

Once all the test results were passed without any major defects and least amount of minor defects/warnings with all enhanced features are working as expected, the ServiceBC agents who are assigned to take the video chats, web chats and co-browse channels are introduced to product documentation and the support portal, along with how to ask for assistance and related actions such as how to collect logs and use the product administration interfaces.

3.1.2 Fusion Application Server and Media Broker Requirements

An operating system is software which has a wide range of definition and is considered as a bridge between human command and hardware response. In layman's terms, an operating system may best be summarized as the spirit and mind which makes objects made of silicon and wire come alive on the screen. Operating systems are categorized in many sublayers due to the provider. As a consequence, each operating system has a strong and weak side which makes it unique and diverse; these minute elements of diversity distinguish them from their competitors. However, many elements play a major role that affect people's denervation. These factors generally include: user-friendliness, cost, support, confidentiality, integrity, capability, and availability.

In this project, CentOS (Community Enterprise Operating System) is chosen which is based on RedHat considering the existing infrastructure at MAXIMUS Canada and also for its strong security. CentOS (from Community Enterprise Operating System) is a Linux distribution that provides a free, community-supported, enterprise-class, computing platform compatible with its upstream source, (RHEL) or Red Hat Enterprise Linux. To deployment Cafe-X features video chat, web chat and co-browse tool to the existing architecture below Fusion application server and Media broker requirements are recommended,

Fusion Application Server, FAS which runs on either of the following:

1. CentOS 6 or CentOS 7
2. 64-bit x86 Red Hat Enterprise Linux Advanced Platform version 6 or 7

MB runs on either of the following:

1. CentOS 6 or CentOS 7
2. 64-bit x86 Red Hat Enterprise Linux Advanced Platform version 6 and 7

3.1.3 Network Infrastructure

Along with the user interface, the backend network infrastructure needs to be properly provisioned in order to support the services with the desired quality levels and at

the desired scale. Video uses the most network bandwidth, and the bandwidth used is dependent upon the resolution, frame rate (fps), and image quality. The resolution and fps of a video stream are set and defined at the start of the call (such as VGA: 640x480 and 30 fps), but the quality or bitrate of the video stream may vary.

Current video streams use adaptive techniques in order to get the best video quality for the bandwidth available. Early video codecs used a fixed quality and therefore a fixed bitrate. This works fine for environments such as DVD or downloaded movies, but does not work well when streaming over the network. This is because the bandwidth available on the network can change over time, and the video stream needs to adapt based on the bandwidth available hence using the term adaptive bitrate.

The higher the bitrate in use, the more data is sent in the video stream and the higher the video quality this also means more bandwidth used on the network. We give a range for the typical bandwidth because the bandwidth used will increase within the bandwidth available in order to give the highest possible bitrate and best quality image.

Below table 3 shows the guidelines used for Cafe-X when considering video bandwidth requirements,

Table 3: Video Bandwidth guidelines recommended by Cafe-X solution

Video Resolution	Video Format (Aspect)	Quality	Typical Bandwidth
352 x 288	CIF (4:3)	Standard Definition (SD)	256 kbps - 511 kbps
640 x 360	nHD (16:9)	SD	480 kbps – 980 kbps
640 x 480	VGA (4:3)	SD	512 kbps – 1023 kbps
1280 x 720	720p (16:9)	High Definition (HD)	1024 kbps - 1920 kbps

The minimum and maximum for the bitrate in the Cafe-X Web Gateway administration panel are set as shown in Figure 16 to ensure that the bitrate is not adapted to above 1024 kb/s and not below 256 kb/s to have a standard definition quality of the video for all the calls and not utilizing more bandwidth for the video. As the incoming calls are initiated by the residents having different network connections, not every customer would be able to adapt with High definition video resolution as a result of which a standard definition is maintained for all the calls to avoid any quality issues or delays in video or connection issues.

Bitrate Settings

Adaptive Bitrate Adjustment Enabled	<input checked="" type="checkbox"/>
Initial Adaptive Bitrate	<input type="text" value="256"/>
Minimum Adaptive Bitrate	<input type="text" value="256"/>
Maximum Adaptive Bitrate	<input type="text" value="1024"/>

Figure 16: Bitrate for CafeX Web Gateway

On the other side, the audio stream carries a lot less data than the video stream and depending on the codec in use, may or may not adapt to the network bandwidth. For this reason, it is always recommended as per standard practice to allocate 100kb/s per

stream for the audio channel. The requirements that co-browsing have on the network depend upon the use case that has been deployed. If the use case includes a constantly changing screen share and lots of documents being pushed, then the bandwidth requirements will be higher than a static screen with no document pushing. It is always recommended in allocating 60kb/s for co-browsing for standard screen sharing.

3.2 Installation of Cafe-X Solution:

Cafe-X solution can be installed by following Cafe-X installation guide once the recommended java environment is available in the existing contact center for ServiceBC. As part of this project, the Java SDKs supported by Cafe-X has been installed and confirmed. With the help of infrastructure and networking teams at MAXIMUS Canada, the main Cafe-X application has been installed on Java platform on both main and standby servers. In this section, the java installation, confirmation of the java versions and removing existing java versions is explained briefly.

3.2.1 Java Installation

Cafe-X solution is recommended to run on Java versions as shown in Table 4. In this project, the Java SE Development Kit is running on Java 7 version and Java Runtime environment is ran on Java 8 version.

Table 4: Java packages with supported versions

Java Package	Supported Versions
Java SE Development Kit (JDK)	<ul style="list-style-type: none"> ■ Java 7 (1.7.0_79 or later)
Java Runtime Environment (JRE)	<ul style="list-style-type: none"> ■ Java 8 (1.8.0_60 and later)

3.2.2 Confirmation of Java Version

Once the Java version has been installed, below commands are used to confirm the Java versions for Java SE Development kit and Java Runtime environment.

Run:

```
# java -version
```

The response:

```
java version "1.7.0_55"
OpenJDK Runtime Environment (rhel-2.4.7.1.el6_5-x86_64 u55-b13)
OpenJDK 64-Bit Server VM (build 24.51-b03, mixed mode)
```

or similar, indicates that OpenJDK is the default Java version.

The response:

```
java version "1.8.0_131"
Java (TM) SE Runtime Environment (build 1.8.0_131-b11)
Java HotSpot (TM) 64-bit Server VM (build 25.131-b11, mixed mode)
```

3.2.3 Removing existing Java Versions

The following command removes all Java packages installed:

```
# yum -y remove java*
```

Following this, the `java -version` command should no longer display a currently installed Java version:

```
# java -version  
-bash: /usr/bin/java: No such file or directory
```

3.3 Solution Configuration:

After the deployment and installation, solution configuration is one of the most important steps in any project. This step involves in integrating all the units in a project both in terms of hardware and software to obtain an integrated final system. During the process of solution configuration, all the Cafe-X components, Linux host CentOS and the MAXIMUS Canada contact center are tied together through network infrastructure. Below are the major three domains to provide enhanced features video chat, web chat and co-browse tool:

3.3.1 Cafe-X components (Fusion Application Server, Fusion Client SDK, Media Broker, Live Assist)

Cafe-X solution is used for enabling mobile applications and websites with real time collaboration (including video chat, co-browsing, on-screen drawing, and other Live Assist features) to increase customer satisfaction and enterprise efficiency. Three major components which are involved in a Cafe-X solution are Fusion Application Server (FAS), Fusion Client SDK and Fusion Web Gateway which helps in securely obtaining the enhanced features video chat, web chat and co-browse in this project.

1. Fusion Client SDK:

One of the major components of Cafe-X solution is Fusion Client SDK which enhances MAXIMUS contact center applications and resident's applications with voice, video, IM, presence & application event distribution sessions. It uses WebRTC to expose voice/video within browsers and integrates with Cisco Jabber which is used by ServiceBC agents at MAXIMUS Canada. It also involves in Application event distribution with shared control and no ball passing and provides platform specific (iOS, Android, JavaScript) libraries for the integrated system.

2. Fusion Web Gateway:

Fusion Web Gateway is another important component of Cafe-X solution which assists in removing signaling complexity between MAXIMUS contact center applications with SIP endpoints and also provides SIP interoperability across integrated system. It helps in HTTP to SIP signaling conversion and control session creation by the contact

center. It relays on HTTP for control channels enabling security through firewall, reverse proxy, etc. and helps in creating and managing sessions for voice/video, IM & presence and application event distribution. Fusion Web Gateway communicates with client application using WebSockets protocol and help to normalize SIP signaling across enterprise, Instant Messaging & Presence Extensions (SIMPLE) for processing by UC presence platform.

3. Fusion Media Broker:

In this project, Fusion Media Broker helps to convert and adapt media between the external clients and enterprise devices for inbound traffic, to simplify & limit RTP for legacy devices for outbound traffic and also adds additional features for browser & mobile clients. It also assists to convert between client app SRTP and SIP compatible RTP streams, translate SDP for enterprise use audio & video transcoding, Network impairment handling (NACK/PLI), Adaptive rate control (REMB/TMMBR), Load balancing (CPU), SRTP termination point, STUN termination point and Media port multiplexing.

3.3.2 Linux Host, CentOS [24]

CentOS (from Community Enterprise Operating System) is a Linux distribution that provides a free, community-supported, enterprise-class, computing platform compatible with its upstream source, (RHEL) or Red Hat Enterprise Linux. CentOS is choosing in this project for below reasons,

1. Security:

In today's world, security is the primary concern that comes to mind and CentOS has multiple security features built-in. One of the ways CentOS helps to protect you from cyber-attacks is by utilizing Security-Enhanced Linux (SELinux). SELinux is an access control mechanism that can enforce rules on processes and files, based on policies that are defined. One of the most beneficial features is that it reduces vulnerabilities on privilege escalation attacks. If a process is compromised, the attacker would only have access to the normal functions of the process, and only the files that process has been configured to have access to.

2. Extended Support:

One of the most important aspect in running any application in production is the stability and support for the platform. With CentOS, major versions are supported for 10 years and will receive security updates as needed. CentOS 7 which is used in this project was released on the 7th of July 2014, and will be supported until June 30th, 2024. CentOS uses a very stable version of its software and because the release cycle is longer, applications do not need to be updated as often. This allows for developers and major corporations who utilize it to save money as it decreases costs associated with additional development time. Fewer upgrades also mean less time downtime for updates. CentOS also supports nearly all hardware forms on the market today, including support for older

hardware types. This allows users to maintain a lower total cost of ownership when considering long term use, including the cost for hardware maintenance.

3. Package Management:

In this project, once the site is in production with all the enhanced features video chat, web chat and co-browse tool it always needs the packages to be updated as and when latest versions are released to avoid any bugs or delays in the quality of these features. CentOS uses the YUM (Yellowdog Updater Modified) package manager to keep the system up to date. This makes the operating system very modular meaning, we can easily add and remove features as we like. CentOS is extremely flexible in its usage and has the ability to be configured to accomplish and accommodate almost any type of task.

3.3.4 Network Infrastructure

There are few major network components involved in the integration of Cafe-X solution to MAXIMUS Canada contact center Fusion Media Gateway, Fusion Application server, Fusion Web gateway, Reverse proxy, firewalls, client apps, SIP trunks as shown in Figure 9 which are configured in order to obtain desired features video chat, web chat and co-browse tool. Fusion Web gateway helps in removing signaling complexity between client app and SIP endpoints and plays a major role in signalling conversions. Fusion Media Broker is another important network component of Cafe-X which helps in converts and adapts media between external clients and enterprise devices; for inbound traffic, simplifies & limits RTP for legacy devices; for outbound traffic adds additional features for browser & mobile clients. With the help of Fusion Web gateway, the incoming HTTP traffic is converted to the SIP signalling to adapt to the SIP trucks of ServiceBC infrastructure at MAXIMUS Canada.

Once the end user i.e., a citizen/resident select an option for communicating on ServiceBC website the request is directed through the cafe-X solution where the Fusion web gateway helps in signalling conversion and Fusion Media Broker helps in providing the Media. The request is sent to the MAXIMUS contact center via SIP trunks and is placed to respective queue of ServiceBC agents. Once the request is in the queue, and there is an available ServiceBC agent it is held for their acceptance. Once the agent accepts the request the confirmation is sent to the citizen and there is a communication link established between them over a secured network using the reverse proxy server.

3.4 System Monitoring:

Once the deployment, installation and configuration of the system has been completed successfully, the final integrated system with Fusion Application server, Fusion Media broker, CPU and memory of the upgraded system needs to be monitored to make sure that the communication is being carried out without any flaws, no delays are

observed in the audio or video packets, no overload of the CPU or memory is observed. In this section, the commands used for monitoring Fusion Application server, Fusion Media Broker and Memory/CPU are detailed.

3.4.1 Fusion Application server

The Fusion Application Server (FAS) is an important component of Cafe-X solution which is the base platform on which the Fusion Web Gateway and Live Assist components are installed. To confirm FAS is running and bound to the expected port (5060 used in this project) following command is executed,

```
$ netstat -anp | grep 5060
tcp 0 0 192.168.9.34:5060 0.0.0.0:* LISTEN 24624/java
udp 0 0 192.168.9.34:5060 0.0.0.0:* 24624/java
```

The output indicates that a Java process is listening for TCP traffic on port 5060, and accepts UDP packets on the same port.

3.4.2 Fusion Media Broker

Fusion Media Broker is another important network component of Cafe-X which helps to convert and adapt media between external clients and enterprise devices; for inbound traffic, simplifies & limits RTP for legacy devices; for outbound traffic adds additional features for browser & mobile clients. To confirm that Media Broker is running and has bound to the expected port (16000 in this project) below command is executed,

```
$ netstat -anp | grep 16000
udp 0 0 ::ffff:192.168.9.34:16000 :::* 11134/java
```

The output indicates that a Java process is open for UDP packets on port 16000.

3.4.3 Monitoring CPU and Memory Usage

By using top command, CPU and memory usage is monitored as if a CPU is at 100% it can lead to unexpected behavior. Using the below command, it can always be ensured that the server has plenty of free CPU and memory,

```
# top
top - 06:17:22 up 23:13, 1 user, load average: 0.04, 0.07, 0.06
Tasks: 83 total, 2 running, 82 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.7 us, 0.6 sy, 0.0 ni, 98.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem : 3881880 total, 127428 free, 3091432 used, 663308 buff/cache
KiB Swap: 1572860 total, 560564 free, 12296 used, 526264 avail Mem

  PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
 20884 root  20  0 3067m 302m 14m S  10.0   7.9  3:37.21  java
 30045 root  20  0 3599m 651m 14m S   2.0  17.0  1:53.64  java
 28920 root  20  0 3218m 405m 10m S   0.3  10.6  0:11.47  java
```

```

28977 root 20 0 2884m 396m 10m S 0.3 10.3 4:50.85 java
  1 root 20 0 19360 1220 984 S 0.0 0.0 0:01.06 init
  2 root 20 0 0 0 0 S 0.0 0.0 0:00.00 kthreadd
  3 root 20 0 0 0 0 S 0.0 0.0 6:10.56 ksoftirqd

```

The output above shows 0.7% CPU usage, which is quite comfortable.

With the help of this chapter, overview of steps involved in deployment, installation and configuration for incorporating Cafe-X components into the existing architecture of MAXIMUS Canada are discussed. The “deployment” involves site preparation and readiness, software installation, Interoperability, Test, and Use Case Verification and handover which are helpful in preparing the infrastructure required in order to implement the enhanced features. “Software installation” is another step which involves installation of Cafe-X solution in MAXIMUS contact center environment without any issues.

After deployment and installation, a major step in order to make everything work and communicate with one another is “configuration”. It involves three important units, (1) Cafe-X components (Fusion Application Server, Fusion Client SDK, Media Broker, Live Assist), (2) Linux Host – CentOS, (3) Network Infrastructure. By configuring all these units, a secure network communication is established between all the integrated units in this project which helps in obtaining the enhanced features. After all these steps, monitoring the final system is a major task as it helps in detecting for any issues/warnings ahead of time so that necessary actions can be taken without any major defects or production loss.

Chapter 4: Testing Approach, Defect tracking process and Results

4.1 Testing:

In this chapter, the detailed test strategy along with testing approach and results has been explained. In order to incorporate additional channels such as video chat, web chat and co-browse for ServiceBC at MAXIMUS Canada, additional infrastructure is needed that is compatible with current architecture supporting channels such as voice, email and text. As part of integration, additional infrastructure has been deployed, installed and configured in MAXIMUS Canada Development, Test and Production environments followed by rigorous testing conducted in each environment. All the testing is done in Silk Central test management software. It is an open test management software that is marketed to improve productivity, traceability, and visibility for all types of software testing.

The primary objectives of this chapter are to:

1. Provide the details on the testing as part of Test Strategy.
2. Identify the specific business scenarios, call flows, message sets and non-functional requirements that require testing for the Video Chat, Web Chat channels and Co-Browse functionality.
3. Identify the test resources required to accomplish the testing.
4. Ensure that integration with Cafe-X solution does not affect the current architecture at MAXIMUS Canada.
5. Test all the enhanced features successfully in Silk Central software without any delays or loss of connections.
6. Test all the features with end-to-end call flow to make sure that all the options mentioned in the requirements are obtained in final application.
7. Test three consecutive web chats in parallel along with one video chat/phone and one co-browse session to confirm the initial requirements are met as part of this project.
8. Test initiating second co-browse session and confirm the failed attempt as per the requirement of this project.
9. Test initiating fourth web chat session from a test citizen/resident and confirm that it stays in the queue until one of the three existing active web chats are disconnected.

The secondary objective of testing application systems will be to:

1. Identify and expose all issues and associated risks.
2. Ensure all issues are addressed appropriately before release.

As a set of objectives, this project will require careful and methodical planning and scheduling to first ensure all areas of the system have been scrutinized and all issues (bugs) found during testing are dealt with to the satisfaction of end users/clients.

4.2 Testing Approach

Testing the final deployed architecture is a crucial and rigorous process in any industry. With the help of testing methodologies and strategies, the time consumption and work involved in performing rigorous testing can be reduced. Testing strategies not only save time but also help in identifying defects well in advance to help fix them before the final output is ready for production.

In this section, testing approach consisting of exploratory testing, integration testing, functional testing followed by complete business acceptance testing has been described in detail.

4.2.1 Exploratory Testing

Exploratory testing is an approach to software testing that is often described as simultaneous learning, test design, and execution. It focuses on discovery and relies on the guidance of the tester to uncover defects that are not easily covered in the scope of other test cases. The following business scenarios are conducted under exploratory testing. This is required to ensure peripheral processes are functioning and to confirm requirements as required.

1. URL Validation – links verified prior to go-live (production)
2. Initial Smoke Testing of Video Chat, Web Chat and Co-Browse to ensure they are ready for functional testing
3. A regression suite is drawn from ServiceBC Test Cases and that include Video Chat, Web Chat and Co-browse test cases. This suite is used for initial testing prior to migration to the Test Environment to ensure all aspects of the Contact Centre Platform have remained in working order after integration of these additional channels
4. All channels are directed to a post interaction survey. Survey regression test scenarios include:
 - a. Phone Surveys not offered when transferred externally
 - b. Verification of Post Interaction Survey with Courtesy Callback Scenarios:
 - i. Callback Request and Disconnect (Hang Up) – no survey offered
 - ii. Callback Request and Agent Return – survey offered

4.2.2 Integration Testing

Integration Testing is defined as a type of testing where all the modules in a project are integrated logically and tested as a group. In this project, all the modules such as

Finesse, PCCE, UpStream, Cafe-X, IDIM mobile application are tested when integrated together to implement enhanced modes of communication video chat, web chat and co-browse. The purpose of this level of testing is to expose defects in the interaction between these modules when they are integrated. It also focuses on checking data communication amongst these modules.

Integration Testing ensures that the entire system works as expected without any defects after integrating existing system with new features. It is required to determine the ability of each of the systems Finesse, PCCE, UpStream, Cafe-X and IDIM mobile application to exchange information. Prior to testing Video Chat and Identity verification, integration between the mobile application and the Finesse desktop will be required to ensure the applications are communicating with each other, including verification of network path.

4.2.3 Functional Testing

Functional testing is usually a black-box testing that ensures the system meets the business requirement. In this project, the functional testing is performed for Video chat, Web chat and Co-browse tool with the respective test cases and validated if it meets the business requirements. The main objective of the functional testing is to verify that the application delivered the functionality as specified in the requirements and as designed.

4.2.3.1 Web Chat

Web chat is one of the enhanced features which has been integrated to the existing architecture of MAXIMUS Canada contact center. Using UML diagram for web chat in Figure 14, below are different scenarios in which web chat has been tested rigorously and identified for any defects such as delays, missing information, quality of the chat, connectivity issues and so on.

1. Call Flow, Message Sets
2. Queuing
3. On Hold
4. Business Hour, Non-Business Hour, Stat Holidays (This testing is done to ensure appropriate messaging and call delivery is accurate given the time of day checks in the contact centre platform. Specific actions such as delivering the call to the queue during business hours or playing “Our Office is now closed” messaging after the Time of Day checks are after hours. This testing includes but is not limited to:
 - a. In Business Hour, agent available
 - b. In Business Hour, agent not available
 - c. In Business Hour, no agent signed in
 - d. Out of Business Hour, Contact Centre Closed Messaging (similar to SMS Text Close Messaging delivery)

- e. Stat Holiday messaging, similar to SMS Text Close Messaging delivery)
- 5. Post Interaction Survey
- 6. Escalations

4.2.3.2 Video Chat

Video chat is one of the enhanced features which has been integrated to the existing architecture of MAXIMUS Canada contact center. Using UML diagram for video chat in Figure 12, below are different scenarios in which video chat has been tested rigorously and identified for any defects such as delays, missing information, quality of the chat, connectivity issues and so on.

- 1. Call Flow, Message Sets,
- 2. Queuing
- 3. On Hold
- 4. Business Hour, Non-Business Hour, Stat Holidays
 - a. In Business Hour, agent available
 - b. In Business Hour, agent not available
 - c. In Business Hour, no agent signed in
 - d. Out of Business Hour, messaging either through the mobile application or Contact Centre Closed Messaging (similar to SMS Text Close Messaging delivery)
 - e. Out of Business Hour, Contact Centre Messaging
 - f. Stat Holiday messaging, (similar to SMS Text Close Messaging delivery)
- 5. Post Interaction Survey
- 6. Escalations
- 7. Camera and Agent desk settings are working and within acceptable quality
- 8. Video Chat end to end testing with IDIM application, and use of ID Check application.

4.2.3.3 ID Check Access and Verification

ID check Access and verification is involved as part of video chat feature which is one of the enhanced features which has been integrated to the existing architecture of MAXIMUS Canada contact center. Using UML diagram for ID Check Access and verification in Figure 13, below are different scenarios in which ID check access and verification chat has been tested rigorously and identified for any defects such as delays, missing information, quality of the chat, connectivity issues and so on.

Use of ID Check will include requesting access to ID Check. Functions include:

1. ID Check Application
 - a. Auto-open browser to correct URL
 - b. Agent login/logout with IDIR
 - c. Access request form

4.2.3.4 Co-Browse

Co-browse is one of the enhanced features which has been integrated to the existing architecture of MAXIMUS Canada contact center. Using co-browse tool as shown in Figure 15, below are different scenarios in which co-browse has been tested rigorously and identified for any defects such as delays, missing information, quality of the chat, connectivity issues and so on.

1. Confirm Co-Browse launches from the website
2. Confirm short-code is received and can be accepted/rejected
3. Test each channel for Co-Browse

4.2.3.5 End to End Testing

End-to-end testing is performed for each component call flow of the ServiceBC contact center in order to detect if the integrated features does not affect other units. Below are different scenarios involved in End-to-end testing,

1. Regression Testing of PCCE, UWF, web text
 - a. End to End testing for all in scope call flows including Business Hours (Courtesy Callback) and Non-Business Hours (including voicemail), and stat holidays, for all Call Flows:
 - b. General Enquiry Menu
 - i. General Enquiry Queue
 - c. Identity Verification by Video round trip
 - i. IDIM mobile application to Service BC Contact Centre Agent a return of acceptance/denial (all use cases)

4.2.3.6 Agent Desktop

ServiceBC agents use Cisco Finesse as Agent desktop where they have access to all their day-to-day activities, taking calls from different channels, taking breaks from their work by changing their status, login/logout, interaction activity tab, directory, UWF statistics and so on. Below are the different scenarios of testing Agent desktop,

1. Finesse Home page:
 - a. Agent login/logout
 - b. Desktop display (agent name, ID, extension, state)

- c. Connection time counter display for each interaction (Video Chat, Web Chat, Co-Browse)
- d. Marquee – view/expand
- e. Manual and automatic change in status (i.e. “Not Ready – Web Chat”, “Not Ready – Video Chat”), pre-set state to transition to, once active interaction completes.

2. Video Chat, Web Chat

Receipt of Video Chat, Web Chat – validating that now all activities below display the Video Chat

- a. Interaction Activity:
 - i. My Tasks - view current and historical interactions of a citizen across all channels
 - ii. Verify maximum number of tasks configured per channel (i.e. agent can only handle x number of SMS conversations at a time)
 - iii. Interaction capture- contact information (name, phone number, email, address)
 - iv. Apply interaction reason code(s)
 - v. My Queues
 - vi. My Day
 - vii. Search interaction history
 - viii. Quick Type Fields -information entered is maintained when transferred to a different queue
- b. Directory – view, filter, search for Agent and queue information (including refresh)
- c. UWF Statistics (agent can only see their own statistics):
 - i. Agent Daily Omni-Channel Statistics
 - ii. Omni-Channel Real Time Statistics
 - iii. Daily Agent Statistics
 - iv. Phone Queue Statistics
- d. Use case testing for Web Chat, Video Chat and Co-Browse
- e. Test that reporting can track multiple interaction legs when a Web Chat or Video Chat session is used

3. Co-Browse

Validate that an agent, from a Live Channel, can launch a co-browse session

- a. Interaction Activity:

- i. My Tasks - view current and historical interactions of a citizen across all channels
- ii. Verify maximum number of tasks configured per channel (i.e. agent can only handle x number of SMS text conversations at a time)
- iii. Interaction capture
- iv. Apply interaction reason code(s)
- v. My Queues
- vi. My Day
- vii. Search interaction history
- viii. Quick Type Fields -information entered is maintained when transferred to a different queue
- b. Directory – view, filter, search for Agent and queue information (including refresh)
- c. UWF Statistics (agent can only see their own statistics):
 - i. Agent Daily Omni-Channel Statistics
 - ii. Omni-Channel Real Time Statistics
 - iii. Daily Agent Statistics
 - iv. Phone Queue Statistics
- d. Use case testing for Voice, Web Chat, Video Chat with a Co-Browse session
- e. Test that reporting can track multiple interaction legs when a Co-Browse session is used

4.2.3.7 Supervisor Desktop

ServiceBC supervisors use Cisco Finesse as supervisor desktop where have access to all their day-to-day activities, taking escalation calls from different channels, taking breaks from their work by changing their status, login/logout, interaction activity tab, directory, UWF statistics, monitoring agent's activities, directory actions, user management actions and so on. Below are the different scenarios of testing Supervisor desktop,

- 1. Home:
 - a. Supervisor login/logout
 - b. Desktop display (Supervisor name, ID, extension, state)
 - c. Connection time counter display for each interaction (voice, SMS, email, Web Chat and Video Chat).

- d. Peripheral call activities (status, wrap up, notes, etc.)
 - e. Refresh
2. Interaction Activity:
- a. My Tasks - view current and historical interactions of a citizen across all channels
 - b. Interaction capture- contact information (name, phone number, email, address)
 - c. My Queues
 - d. My Day
 - e. Search interaction history
3. Monitoring Activities:
- a. UWF Statistics for assigned team(s): Agent daily Omni-Channel Statistics, Omni-Channel Real Time Statistics, Daily Agent Statistics, Phone Queue Statistics
 - b. Team: Team Performance window, Queue Statistics window
4. Task Bar:
- a. Verify current and parked interactions are visible across all channels for a given Agent.
 - b. Verify Citizen contact information is associated for a given interaction
 - c. Verify that a historical preview is present for each incoming contact (date of last contact, reason for last contact, number of recent contacts, number of enquiries in process across all channels)
 - d. Assign tasks to agents based on skill
 - e. Verify calls remain priority, then text, then email
5. Directory Actions:
- a. Add/remove queue or Agent contact information
 - b. Search or filter for queue or Agent information based on available drop-downs (queue type, region, group, role)
 - c. Refresh
6. User Manager Actions:
- a. Assign/remove skills
 - b. Assign instance
 - c. Assign location
 - d. Assign maximum tasks handled by an Agent for a given channel
 - e. Add/modify Agent details

- f. Add/modify Agent email signature
- g. Add/assign Agent Out of Office

4.2.3.8 All Channels

Below are few test scenarios which needs to be tested and which are related to all the channels involved with contact center for ServiceBC.

1. Channel priority: Test the priority of each interaction is as set out in the functional requirements. Examples of priority below,
 - a. Voice Calls and Video Chats take priority
 - b. Web Chat and SMS the same as SMS
 - c. Email
2. Time of day and holiday check (business hours, non-business hours, statutory holidays), all channels
3. Inbound Video Chat/Web Chat acceptance based on skill
4. Inbound call alert (“beep”) in agent’s headset for auto-answer of inbound Video Chat/Web Chat
5. Inbound call information display (customer dialed number, customer phone number, destination queue name when transferred)
6. Outbound call, SMS, Web Chat
7. Hold/retrieve on-hold – all channels
8. Conference scenarios:
 - a. Initiate internal consult (three-way conference)
 - b. Agent ends interaction (call disconnect)
 - c. Citizen ends interaction
 - d. Courtesy callback
9. Peripheral Channel activities (status, wrap up, notes, etc.)
10. Shared group contact activities (phonebook, transfer)
11. After hours voice mail
12. Regression testing of voice
13. Small regression execution

4.2.3.9 Reporting

Reporting is the most important unit in any organization. With the help of reporting, an organization can analyze the incoming call flows, agent’s availability, call qualities,

customer reviews and satisfaction, peak hours, number of calls answered, number of calls abandoned, agents count, number of transfers, UWF statistics and so on.

Below are reporting scenarios which needs to be tested consisting of all channels data, with the help of these testing we can identify if the specified requirements and capacities are met or not without any delays or overflows.

1. SBC Supervisor Dashboards for new queues and channels
2. Standard Stock Reports: each report will be scrutinized to identify those reports that will display results for Video Chat, Web Chat and Co-Browse.
 - a. Agent Historical All Fields
 - b. Agent Login Logout Historical
 - c. Agent Not Ready Historical
 - d. Agent Queue Real Time
 - e. Agent Real Time
 - f. Agent Skill Group Historical All Fields
 - g. Agent Team Historical All Fields
 - h. Agent Team Not Ready Historical
 - i. Agent Team Real Time
 - j. Agent Team State Counts Real Time
 - k. Call Type Abandon-Answer Distribution Historical
 - l. Call Type Historical All Fields
 - m. Call Type Real Time
 - n. Callback Current
 - o. Callback Historical
 - p. Peripheral Skill Group Historical All Fields
 - q. Peripheral Skill Group Real Time All Fields
 - r. Skill Group Abandon-Answer Distribution Historical
 - s. Skill Group Not Ready Detail Real Time
 - t. Skill Group Not Ready Real Time
3. UWF Stock Reports:
 - a. each report will be scrutinized to identify those reports that will display results for Video Chat, Web Chat and Co-Browse
 - b. Agent Activity Interval
 - c. Skill Activity Interval

- d. Team Skill Activity Interval
 - e. Frequent Contacts
 - f. Interaction Detail
 - g. Supervisor Completed Tasks
 - h. Transfer In
 - i. Transfer Out
4. Telephony & Performance Reports: each report will be scrutinized to identify those reports that will display results for Video Chat, Web Chat and Co-Browse
- a. Citizen Satisfaction Survey Report (voice, email, SMS-Text)
 - b. Monthly IVR Report
 - c. Volume Report
 - d. Detailed Telephony Report – Program
 - e. Detailed Telephony Report – Agent
 - f. Telephony Usage Report
 - g. Trending Report
 - h. Resolution Statistics Report
 - i. Service BC Report
 - j. Incident Report
5. Omni-Channel Interaction Reports: each report will be scrutinized to identify those reports that will display results for Video Chat, Web Chat and Co-Browse
- a. Digital Channel Usage Report
 - b. Detailed Digital Channel Report - Program
 - c. Detailed Digital Channel Report - Agent
 - d. Verify all emails are logged to Interaction History and Uptake Reporting Database
 - e. Verify all SMS-Text interaction transcripts are recorded
6. Knowledge Base & Service Desk (CA Service Desk Manager): each report will be scrutinized to identify those reports that will display results for Video Chat, Web Chat and Co-Browse
- a. Knowledge Base Report Card
 - b. Knowledge Base Currency Report

- c. Escalation Tracking Report
- d. Complaint Tracking Report

4.2.4 Business Acceptance Test

The Acceptance Testing is a testing technique performed to ensure the complete system has reached the requirement specifications. In effect, what the acceptance testing is doing is that it confirms the system to meet the required criteria for the delivery of the project. Acceptance Testing is performed just after the System Testing and ensures the system is available for the actual use.

The Acceptance Testing is the Black Box Tests, where the tester need not be aware of the internal structure of the code and they just specify the inputs and analyze the output and compare the expected result with the actual result. The Acceptance testing is the level of testing where the acceptance of the project is ensured for the clients.

The Major Objectives of Acceptance Testing

1. Resolve discrepancies to ensure a perfect result.
2. Confirm the readiness of the system to live-performance.
3. Ensure the exact operations and functionalities as per the agreed criteria.
4. Acceptance criteria should be related to the Business objectives of the clients.

It is the final stages of a project to ensure that the incorporation of video Chat, web chat along with co-browse to existing architecture of ServiceBC at MAXIMUS Canada fulfills the business needs and satisfies the end customers/users using test cases based on testing the quality, delays, connection strength of the call. Acceptance testing will also cover off Usability – screen navigation/button response time, interaction latency (SMS, Video Chat, Web Chat, Co-browse), reporting response time, and video quality.

4.2.4.1 Acceptance Tests

Public Testing – public testing of the public end of the Call Flows is done in this testing.

1. Testing of the various Service BC channels, menus and call flows primarily to test the messages are correct for each flow and cadence is acceptable.
2. Formal testing of call flows through to Agents as prelaunch for Agent verification and validation of the Finesse Screens.
3. Verification report on Valid URL Links prior to production

Agent Testing – Agent testing will include the following:

1. Camera and Agent desk settings are working and within acceptable quality
2. Pickup of calls generated by public testers and verification and validation of the PCCE Finesse, Upstream, and SMS screen displays.

3. Verint Impact 360 Workforce Management – Verification and validation of screen displays and Adherence.
4. TelStrat Call Recording – Verification that all interactions are recorded (both screens and voice including Web Chat and Video Chat interactions that occur without a live phone call.
5. VoIP Telephone sets and headsets.
6. Agent VDI pool login
7. Access to ID Check system

Supervisors – Supervisor testing will include the following:

1. Monitoring Activities Validation

Schedulers – Work Force Management Scheduling

4.3 Defect Tracking:

Defect tracking is done through Silk Central Test Manager (Test Management) and StarTeam (Configuration Management) tools. This section identifies the process on how defects are identified, tracked and managed during all testing phases of the project. “StarTeam” is the tool which is used for tracking the defects for this project. It is a software change management and configuration management tool that enables coordination and management of the software delivery process.

The stages in the defect cycle are as follows:

1. **Identification** – When an issue is identified, it is logged in SilkCentral [28] Test Manager against the test that failed.
2. **Triage** - Triage is the activity of discussing, categorizing, prioritizing and assigning severity levels to defects.
3. **Assignment** - The assignment process is to assign each defect to the respective unit for it to be fixed.
4. **Resolution** – After making necessary changes, a unit test is performed and a resolution is entered into the defect management tool along with the build that will contain the fix.
5. **Re-Testing and Regression Testing** – Once the resolution is entered into the defect management tool (StarTeam), the system is re-tested.

4.4 Defect Tracking Process:

The following process is identified for the resolution of all discrepancies, defects and enhancements.

1. Defects/enhancements is been logged as and when discovered. All the details required to reproduce the defect had been collected. Once the defect is logged, the system

- sends an email notification that a defect has been assigned. This initial defect logging has a default status of “New”.
2. Once the notification of the defect has been received, the initial assessment of the defect for clarity, priority and severity is performed. The defect still maintains a status of “New”.
 - a. If it is specified as a defect, it is then further assessed for analysis/resolution.
 - b. If it is specified as an enhancement, it is logged to the Enhancement List. An enhancement is a suggestion or a piece of functionality that is not a part of the requirements but may be identified to increase system functionality, usability or efficiency.
 3. Defects will be prioritized and worked on according to the following:
 - a. Severity:
 - i. High/Critical: High/Critical severity is a defect that results in the failure of the complete software system, of a subsystem, or of a software unit (program or module) within the system. There is no workaround and testing cannot continue.
 - ii. Medium: Medium severity defects are those that do not result in a failure but cause the system to produce incorrect, incomplete, or inconsistent results, or the defect impairs the system’s usability. There is a possible workaround so testing can continue.
 - iii. Low: Low severity defects are those that do not cause a failure, do not impair usability, are the result of non-conformance to a standard, are related to the aesthetics of the system, or are requests for enhancement. There is an acceptable and easily reproducible workaround. Testing can proceed without interruption.
 - b. Priority:
 - i. High: This type of defect has a major impact on the customer. This must be fixed immediately.
 - ii. Medium: This type of defect has a major impact on the customer. The problem should be fixed before release of the current version in development, or a patch must be issued if possible.
 - iii. Low: This has a minor impact on the customer. The flaw should be fixed if there is time, but it can be deferred until the next release.
 4. Enhancements will be prioritized and worked on according to the following:
 - a. All enhancements will be assessed and prioritized as follows:
 - i. All easy to accomplish enhancements and/or any enhancements deemed to have a high priority or which involve a module that is currently being worked on will be assessed within 2 days of the request and a resolution/closure timeline established for a delivery if at

all possible. If this is not possible, a timeline for resolution will be determined and the enhancement will be tracked to this resolution timeline.

- ii. All enhancements deemed of Medium priority must be assessed within 2 days of the request and resolved/closed within 5 days of the initial request if at all possible. If this is not possible a timeline for resolution will be determined and the enhancement will be tracked to this resolution timeline.
 - iii. All enhancements deemed Low priority will be assessed within 2 days and if it is decided to hold this over for future resolution, they will be documented in the Defect Action Plan to be reprioritized and a plan of action documented. This would include the documentation of a decision to defer the enhancement for post implementation resolution.
5. Once the notification of defect is received, the status of the defect is set to “Open” and an initial assessment is performed of what is required to resolve the defect.
 6. The status is set to “In Progress” and an assessment of the defect is performed to determine a resolution. Once a decision has been made as to the estimated resolution of the defect, for all status but Fix, the defect is changed to the appropriate status. Status choices include:
 - a. As Designed
 - b. Documented
 - c. Fix
 - d. Is Duplicate
 - e. Cannot Reproduce
 7. Once defects have been resolved, the defect is identified as fixed and a new build is specified through the “Addressed in Build” field.
 8. Then it is re-tested and regression or to verify that the resolution status is correct.
 - a. If it is correct, the status is changed to “Verified” and assigns the defect is closed.
 - b. If it is not correct, additional information is logged on why the status is incorrect and the defect re-enters the entire process once more.
 9. A notification is received of the verified defect and it is scheduled for final review and closure.

4.5 Results:

In this section, the final results of deployment showing the integrated ServiceBC webpage with all the modes of communication phone, text, email, video chat, web chat with co-browse options is shown. This section also provides the results for Exploratory testing, Integration Testing, Functional Testing and Business Acceptance testing showing

the number of test cases passed, failed and not executed along with the final test result for that test. As part of testing results, a sample video chat, web chat and co-browse session showing different steps involved during the communication between a test ServiceBC agent and test citizen is shown using screenshots. With the help of all these results it is shown that all the test results were positive and as expected as per the requirements set in this project.

4.5.1 Extended Modes of communication for ServiceBC at MAXIMUS Canada after integration with Cafe-X Solution

Before integration, ServiceBC contact center at MAXIMUS Canada provides three modes of channels phone, text and email for its residents to communicate with agents. Using these channels residents/citizens still need to visit their nearby ServiceBC office for MSP validation, filling health related forms, submitting documents as part of verification, adding additional information on to their profile and so on. This process delays overall service time for end users especially residents living in remote locations by not allowing them to receive services until the process has been completed and verified manually. This leads to longer wait times which is leading to one of the major drawbacks in healthcare of Canada.

By integrating Cafe-X solution with existing MAXIMUS Canada contact center, three new modes of channels are obtained video chat, web chat and co-browse tool. Figure 17 shows a screenshot of ServiceBC website with enhanced modes of channels video chat, web chat and co-browse along with existing channels phone, text and email. When a citizen/ resident clicks on any of these channels, they are provided with two options, (1) “connect to the agent”- which will connect to agent through that selected channel and (2) “Already on call, generate short code” – this option is to initiate co-browse session when they are already in conversation with the agent. With the help of these additional channels, the processing time is reduced by eliminating the need for residents to manually visit ServiceBC office and providing all the services as quickly as possible with minimal wait times.

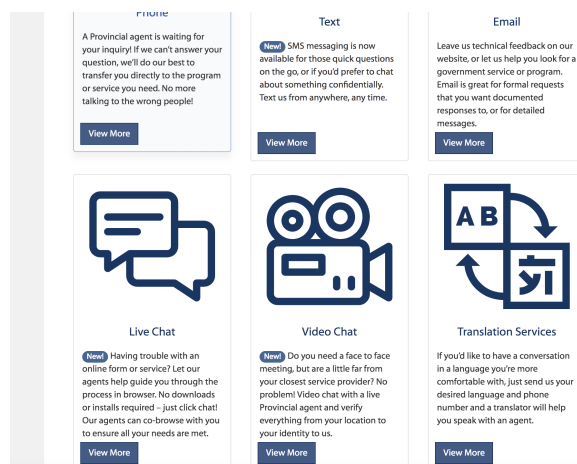


Figure 17: ServiceBC website with enhanced modes of channels

Currently, one ServiceBC agent can handle at max of one video chat/phone, three web chats, one co-browse, three texts and multiple email sessions in parallel due to limited network infrastructure (SIP Trunks) available at MAXIMUS Canada. These parameters can be increase by increasing the required infrastructure at contact center. This test shows that the integration of enhanced features to the existing architecture was successful.

4.5.2 Exploratory Testing

Exploratory testing is an approach where testing is often performed on the fly and described as simultaneous learning, test design, and execution. In this project, it focuses on discovery of uncover defects that are not easily covered in the scope of other test cases. As part of Exploratory testing, below business scenarios are tested. This testing is required to ensure peripheral processes are functioning as expected as per the requirements and also to confirm that incorporating the Cafe-X components to the existing architecture to implement additional modes of communication did not lead to any defects/ warning in any other units of the architecture of ServiceBC at MAXIMUS Canada. As part of Exploratory testing, below tests are build and executed.

The initial results for all the test cases in Figure 18 shows that few tests are failed. All the failed events are tagged and logged into the star team and based on the cause for the fail, the defect is sent to respective team to fix it. After the defect is analyzed and fixed, the testing procedure is repeated again for all the test cases. This process of testing, logging the defects, fixing the issues and re-testing is continued until the final results for all the test cases are pass as shown in Figure 19.

1. URL Validation – links verified prior to go-live (production)
2. Initial Smoke Testing of Video Chat, Web Chat and Co-Browse to ensure they are ready for functional testing
3. A regression suite is drawn from ServiceBC Test Cases and that include Video Chat, Web Chat and Co-browse test cases. This suite is used for initial testing prior to migration to the Test Environment to ensure all aspects of the Contact Centre Platform have remained in working order after integration of these additional channels
4. All channels are directed to a post interaction survey. Survey regression test scenarios include:
 - a. Phone Surveys not offered when transferred externally
 - b. Verification of Post Interaction Survey with Courtesy Callback Scenarios:
 - i. Callback Request and Disconnect (Hang Up) – no survey offered
 - ii. Callback Request and Agent Return – survey offered

Exploratory Test case									
Test	Test components	Test case	Steps involved	Status			Final Test result	Comments	
				Pass	Fail	Not Executed/Skip			
URL	URL Validation	open URL	3	3	0	0	0	Pass	
		URL Validation	4	4	0	0	0	Pass	
Smoke Test of Channel Expansion	Video chat	Re-join URL	5	5	0	0	0	Pass	
		Call flow	20	20	0	0	0	Pass	
		Message sets	15	15	0	0	0	Pass	
		Queueing	18	17	1	0	0	Pass	No queueing music played
		On Hold	9	9	0	0	0	Pass	Citizen hold is still in design
		In Business Hour, agent available	22	22	0	0	0	Pass	
		In Business Hour, agent not available	22	22	3	0	0	Pass	
		In Business Hour, agent not signed in	25	24	0	1	0	Pass	Out of office voice message is updated
		Out of Business Hours	21	14	7	0	0	Pass	The call does not go to out of office queue
		Stat Holiday	18	14	4	0	0	Pass	Call does not play stat holiday music correctly
		Post Interaction Survey	23	17	3	3	0	Pass	No survey offered to caller
		Escalations	22	22	0	0	0	Pass	
		Camera & Agent settings	7	7	0	0	0	Pass	
		End-to-end testing	25	25	0	0	0	Pass	
		ID Check access and Verification	Auto-open browser to correct URL	Agent login/logout through IDIR	6	2	4	0	Pass
Access Request form	7			7	0	0	0	Pass	Agent does not have access to ID check
Web chat	Call flow	Message sets	21	15	6	0	Pass	Not able to attach file or images	
		Queueing	15	15	0	0	0	Pass	
		On Hold	19	15	4	0	0	Pass	Issue with multiple webchats at one time
		In Business Hour, agent available	9	9	0	0	0	Pass	
		In Business Hour, agent not available	23	23	0	0	0	Pass	
		In Business Hour, agent not signed in	24	24	0	0	0	Pass	
		Out of Business Hours	25	24	0	0	0	Pass	
		Stat Holiday	21	14	7	0	0	Pass	Out of office voice message is updated
		Post Interaction Survey	23	17	3	3	0	Pass	Call does not play stat holiday music correctly
		Escalations	23	17	3	3	0	Pass	No survey offered to caller
Co-browse	Co-browse launch from website	Confirm short code accept/reject	22	22	0	0	Pass		
		Test each channel with co-browse	4	1	3	0	Pass	code does not work	
Regression suite	ServiceBC	Confirm short code accept/reject	6	0	6	0	Pass	code does not work	
		Test case folder	27	20	7	0	Pass	Issue with channels	
		Test case folder	52	40	8	4	Pass	out of scope of this project	
		Test case folder	43	32	6	5	Pass	out of scope of this project	
		Test case folder	21	14	5	2	Pass	out of scope of this project	
		Test case folder	20	15	0	5	Pass	out of scope of this project	
		Test case folder	18	12	0	6	Pass	out of scope of this project	
		Test case folder	13	5	8	0	Pass	out of scope of this project	
		Test case folder	68	50	10	8	Pass	out of scope of this project	
		Survey	Post Interaction survey	survey not offered when transferred externally	23	17	3	3	Pass
		Post Interaction Survey with Call back	28	22	6	0	Pass	Issue with Post call interaction survey	

Figure 18: Exploratory Testing Results -1st Cycle

The field “test” shows the main folder under exploratory testing involving the test components. Each test component is built with number of test cases with each test case having number of steps involved with them. The field under “steps involved” provides the number of steps involved under each test case for example steps involved in “Open URL” test case is 3 meaning there are three steps namely, (1) click on the URL, (2) Press Enter, (3) open the URL page, the same applies to all the test cases.

The result of each test case is show under “status” field with three annotations pass, fail and not executed with respective colour coding. The “pass” field states the number of steps passed successfully or executed as expected. The ‘fail’ field states the number of steps failed or not executed as expected. The “Not executed” field states how many test steps were not executed or out of scope for this project. The final test result is decided from the number of pass, fail test cases. The “comment” section provides the details of the issues/warnings.

All the test case folders under each test are self-explanatory such as “on hold”, “call flow” so on. Stat holiday folder has steps involved when the citizen calls the queue on a statutory holiday and the call is diverted to the stat holiday music once it hits the queue and stat holiday is yes. Message sets is the steps involved in each and every message which is played to the citizen when they call the queue such as welcome message, queue information message and so on. Post Interaction survey refers to the steps involved when citizen disconnects the call with the agent and the citizen is offered with the survey to understand the quality of the service provided. The term “Test case folder” refers to redirecting to respective test case folders based on the test component which are part of other areas of MAXIMUS Canada architecture, not related to the project but are tested to see if they are not affected due this integration.

As shown in Figure 18, there are number of tests failed in 1st cycle of Exploratory testing such as no queuing music played, no survey offered to the caller, unable to access ID check webpage by the agent, issue with multiple webchat initiated at a time, unable to attach files or images through web chat as expected, issue with post call interaction survey with wrong survey messages and so on. All these issues are logged into star team and sent to respective teams for them to fix and re-tested in multiple cycles until no fail events are found with all pass test results as shown in figure 19. Few causes of these issues are improper routing of the call due to configuration, issue with network to load the ID check application, survey use case is not accessible due to improper network routing, not able to access multiple webchats at a time due to no media recourses available and so on. All these issues are addressed by collaborating with different teams and re-testing to confirm if it has been fixed.

Exploratory Test case								
Test	Test components	Test case	Steps involved	Status			Final Test result	Comments
				Pass	Fail	Not Executed/Skip		
URL	URL Validation	open URL	3	3	0	0	Pass	
		Refresh URL	4	4	0	0	Pass	
		Re-join URL	5	5	0	0	Pass	
Smoke Test of Channel Expansion	Video chat	Call flow	20	20	0	0	Pass	
		Message sets	15	15	0	0	Pass	
		Queuing	18	18	0	0	Pass	
		On Hold	9	9	0	1	Pass	Citizen hold is still in design
		In Business Hour, agent available	22	22	0	0	Pass	
		In Business Hour, agent not available	22	22	0	0	Pass	
		In Business Hour, agent not signed in	25	24	0	1	Pass	Out of office voice message is updated
		Out of Business Hours	21	21	0	0	Pass	
		Stat Holiday	18	18	0	0	Pass	
		Post Interaction Survey	23	23	0	0	Pass	
		Escalations	22	22	0	0	Pass	
		Camera & Agent settings	7	7	0	0	Pass	
		End-to-end testing	25	25	0	0	Pass	
	ID Check access and Verification	Auto-open browser to correct URL	6	6	0	0	Pass	
		Agent login/logout through IDIR	4	4	0	0	Pass	
		Access Request form	7	7	0	0	Pass	
	Web chat	Call flow	21	21	0	0	Pass	
		Message sets	15	15	0	0	Pass	
		Queuing	19	19	0	0	Pass	
		On Hold	9	9	0	0	Pass	
		In Business Hour, agent available	23	23	0	0	Pass	
		In Business Hour, agent not available	24	24	0	0	Pass	
		In Business Hour, agent not signed in	25	24	0	0	Pass	
		Out of Business Hours	21	21	0	0	Pass	
		Stat Holiday	18	18	0	0	Pass	
		Post Interaction Survey	23	23	0	0	Pass	
		Escalations	22	22	0	0	Pass	
	Co-browse	Co-browse launch from website	4	4	0	0	Pass	
		Confirm short code accept/reject	6	6	0	0	Pass	
		Test each channel with co-browse	27	27	0	0	Pass	
Regression suite	ServiceBC	Test case folder	52	48	0	4	Pass	out of scope of this project
	HBC	Test case folder	43	38	0	5	Pass	out of scope of this project
	SMS	Test case folder	21	19	0	2	Pass	out of scope of this project
	Pharmacare	Test case folder	20	15	0	5	Pass	out of scope of this project
	Pharmanet	Test case folder	18	12	0	6	Pass	out of scope of this project
	Fax	Test case folder	13	13	0	0	Pass	out of scope of this project
	Channel expansion	Test case folder	68	60	0	8	Pass	
Survey	Post interaction survey	survey not offered when transferred externally	23	23	0	0	Pass	
		Post Interaction Survey with Call back	28	28	0	0	Pass	

Figure 19: Exploratory Testing Results – Final Cycle

4.5.3 Integration Testing

Integration Testing ensures that the entire system works as expected without any defects after integrating existing system with new features. It is required to determine the ability of each of the systems Finesse, PCCE, UpStream, Café-X and IDIM mobile application to exchange information. Prior to testing Video Chat and Identity verification, integration between the mobile application and the Finesse desktop will be required to ensure the applications are communicating with each other, including verification of network path. As part of Integration testing below tests are build and executed as shown in Figure 20.

The initial results for all the test cases in Figure 20 shows that few tests are failed. All the failed events are tagged and logged into the star team and based on the cause for the

fail, the defect is sent to respective team to fix it. After the defect is analyzed and fixed, the testing procedure is repeated again for all the test cases. This process of testing, logging the defects, fixing the issues and re-testing is continued until the final results for all the test cases are pass as shown in Figure 21.

Integration Test case								
Status								
Test	Test components	Test case	Steps involved	Pass	Fail	Not Executed/Skip	Final Test result	Comments
Integration	Finesse	Finesse Folder	31	25	6	0	Pass	Some of the finesse desktop options were not as expected
	PCCE	PCCE Folder	13	12	0	1	Pass	Out of scope for this project
	UpStream Works	UpStream Works folder	17	9	6	2	Pass	Calls are not recorded as expected
	Cafe-X components	Cafe-X components folder	23	17	6	0	Pass	Queing, web chats and so on
	IDIM Mobile Application	IDIM Mobile folder	8	8	0	0	Pass	

Figure 20: Integration testing results – 1st cycle

The field “test” shows the main folder under exploratory testing involving the test components. Each test component is built with number of test cases with each test case having number of steps involved with them. The field under “steps involved” provides the number of steps involved under each test case for example steps involved in “Finesse Folder” shows as 31 meaning checking the login/logout option, agent name displaying correct or not, checking if all status is available for agent to change and so on, the same applies to all the test cases.

The result of each test case is show under “status” field with three annotations pass, fail and not executed with respective colour coding. The “pass” field states the number of steps passed successfully or executed as expected. The “fail” field states the number of steps failed or not executed as expected. The “Not executed” field states how many test steps were not executed or out of scope for this project. The final test result is decided from the number of pass, fail test cases. The “comment” section provides the details of the issues/warnings.

The test case folder “Finesse” indicates all the steps involved in checking the option available on the Finesse desktop after integration if they are as expected to the requirements or not. The folder “Upstream works” indicates all the options and recording confirmations, delays involved, quality of the channels etc. if they are as expected to the requirements. The folder “PCCE” indicates if all the PCCE functionalities are running as expected after integration. “Cafe-X components” folder tests all the new features incorporated through this project. “IDIM mobile” folder indicates and tests all the IDIM apps and client apps involved through this integration.

As shown in Figure 20, there are number of tests failed in 1st cycle of Integration testing such as issues with Finesse desktop such as the agent’s name who has logged into finesse is not displayed properly, few status changes are not available after integration, few agent options not available, Issues with Upstream works such as calls are not recorded as expected, delays seen in the recording and so on. Issues with Cafe-X components such as discussed in exploratory testing and same for all other test components. All these issues are logged into star team and sent to respective teams for them to fix and re-tested in multiple cycles until no fail events are found with all pass test

results as shown in figure 21. Few causes of these issues are improper routing of the call due to configuration, Upstream works not recording new features due to port closure for recording, survey use case is not accessible due to improper network routing, not able to access multiple webchats at a time due to no media recourses available and so on. All these issues are addressed by collaborating with different teams and re-testing to confirm if it has been fixed.

Integration Test case								
Test	Test components	Test case	Steps involved	Status			Final Test result	Comments
				Pass	Fail	Not Executed/Skip		
Integration	Finesse	Finesse Folder	31	31	0	0	Pass	
	PCCE	PCCE Folder	13	12	0	1	Pass	Out of scope for this project
	UpStream Works	UpStream Works folder	17	15	0	2	Pass	Out of scope for this project
	Cafe-X components	Café-X components folder	23	23	0	0	Pass	
	IDIM Mobile Application	IDIM Mobile folder	8	8	0	0	Pass	

Figure 21: Integration testing Results – Final cycle

4.5.4 Functional Testing

Functional testing is usually a black-box testing that ensures the system meets the business requirement. In this project, the functional testing is performed for Video chat, Web chat and Co-browse tool with the respective test cases and validated if it meets the business requirements. The main objective of the functional testing is to verify that the application delivered the functionality as specified in the requirements and as designed. In Functional Testing the main functionalities involved with all the additional channels are tested. As part of Functional testing below tests are build and executed.

The initial results for all the test cases in Figure 22 shows that few tests are failed. All the failed events are tagged and logged into the star team and based on the cause for the fail, the defect is sent to respective team to fix it. After the defect is analyzed and fixed, the testing procedure is repeated again for all the test cases. This process of testing, logging the defects, fixing the issues and re-testing is continued until the final results for all the test cases are pass as shown in Figure 23.

1. Smoke Test of the complete channel expansion features which includes video chat, Web chat, Co-browse and ID Check and verification.
2. End-to-End testing of complete Regression suite which includes all the components of MAXIMUS Canada architecture ServiceBC, HIBC, SMS, Pharmacare, Pharmanet, Fax including video chat, web chat and co-browse functionalities. This test will ensure that all the components of the architecture are working as before without any issues which could have been caused by this integration.
3. All options available on the agent finesse desktop are tested including the new incorporated features video chat, web chat and co-browse.
4. All options available on the supervisor finesse desktop are tested such as home, monitoring activities, interaction activities, task bar, user manager bar including the new incorporated features video chat, web chat and co-browse.

5. “All Channels” ate tested for Channel priority, Time of day and holiday check, Inbound Video Chat/Web Chat acceptance based on skill, Inbound call alert , Inbound call information display, Outbound call, SMS, Web Chat, Hold/retrieve conference scenarios, Peripheral channel activities (status, wrap up, notes, etc.), shared group contact activities (phonebook, transfer), after hours voice mail, regression testing of voice, small regression execution.
6. All the reports involved in the “Reporting” are tested such as SBC Supervisor dashboards, Standard Stock Reports, UWF Stock Reports, Telephony & Performance Reports, Omni-Channel Interaction Reports and Knowledge Base & Service Desk Reports.

Functional Test case							
Test	Test components	Test case	Steps			Final Test result	Comments
			involved	Pass	Fail/Executed/Skip		
Smoke Test of Channel Expansion	Call flow		20	20	0	0	Pass
	Message sets		15	15	0	0	Pass
	Queuing		18	17	1	0	Pass
	On Hold		9	9	0	1	Pass
	In Business Hour, agent available		22	22	0	0	Pass
	In Business Hour, agent not available		22	22	3	0	Pass
	In Business Hour, agent not signed in		25	24	0	1	Pass
	Out of Business Hours		21	14	7	0	Pass
	Stat Holiday		18	14	4	0	Pass
	Post Interaction Survey		23	17	3	3	Pass
	Escalations		22	22	0	0	Pass
	Camera &Agent settings		7	7	0	0	Pass
	End-to-end testing		25	25	0	0	Pass
	Auto-open browser to correct URL		6	2	4	0	Pass
	Agent login/logout through IDIR		4	2	2	0	Pass
	Access Request form		7	7	0	0	Pass
	Call flow		21	15	6	0	Pass
	Message sets		15	15	0	0	Pass
	Queuing		19	15	4	0	Pass
	On Hold		9	9	0	0	Pass
	In Business Hour, agent available		23	23	0	0	Pass
	In Business Hour, agent not available		24	24	0	0	Pass
	In Business Hour, agent not signed in		25	24	0	0	Pass
Out of Business Hours		21	14	7	0	Pass	
Stat Holiday		18	14	4	0	Pass	
Post Interaction Survey		23	17	3	3	Pass	
Escalations		22	22	0	0	Pass	
Co-browse launch from website		4	1	3	0	Pass	
Confirm short code accept/reject		6	0	6	0	Pass	
Test each channel with co-browse		27	20	7	0	Pass	
Regression suite- End-to-End	ServiceBC	Test case folder	52	40	8	4	Pass
	HIBC	Test case folder	43	32	6	5	Pass
	SMS	Test case folder	21	14	5	2	Pass
	Pharmacare	Test case folder	20	15	0	5	Pass
	Pharmanet	Test case folder	18	12	0	6	Pass
	Fax	Test case folder	13	5	8	0	Pass
	Channel expansion	Test case folder	68	50	10	8	Pass
Agent Desktop	Finesse Home Page	Test case folder	16	13	3	0	few options are not displayed as expected
	Video chat	Test case folder	15	12	3	0	delays observed in audio and video, no hold etc.
	web chat	Test case folder	17	11	6	0	not able to attach file or images, issue with opening message
	Co-browse	Test case folder	19	16	0	3	In development
Supervisor Desktop	Home	Test case folder	18	15	3	0	Few options are not displayed as expected
	Interaction Activity	Test case folder	7	7	0	0	
	Monitoring Activities	Test case folder	6	6	0	0	
	Task Bar	Test case folder	11	7	4	0	Few options are not available
	Directory Actions	Test case folder	12	11	0	1	out of scope for this project
All Channels	User Manger Actions	Test case folder	4	4	0	0	
	Channel Priority	Test case folder	3	3	0	0	
	Time of Day and Holiday check	Test case folder	5	3	2	0	Not working
	Inbound video chat/phone acceptance	Test case folder	7	7	0	0	
	Inbound call alert	Test case folder	3	1	2	0	No alert
	Inbound call information display	Test case folder	5	3	2	0	Incorrect information
	Outbound call, SMS, Web chat	Test case folder	26	20	6	0	
	Hold/ Retrieve	Test case folder	7	4	3	0	
	Conference scenarios	Test case folder	18	12	6	0	
	Pheripheral channel activities	Test case folder	14	14	0	0	
	Shared group contact activities	Test case folder	12	7	0	5	out of scope for this project
	After hours voice mail	Test case folder	3	3	0	0	
	Regression testing of voice	Test case folder	18	18	0	0	
	Reporting	Small regression execution	Test case folder	5	5	0	0
SBC supervisor dashboard		Test case folder	28	28	0	0	
Standard stock reports		Test case folder	7	7	0	0	
UWF stock reports		Test case folder	12	12	0	0	
Telephony & Performance reports		Test case folder	11	11	0	0	
Omni-channel interaction reports		Test case folder	11	11	0	0	
Knowledge base & Service Desk	Test case folder	16	16	0	0		

Figure 22: Functional Testing results – 1st cycle

The field “test” shows the main folder under functional testing involving the test components. Each test component is built with number of test cases with each test case having number of steps involved with them. The field under “steps involved” provides the number of steps involved under each test case for example steps involved in “On hold” test case is 9 meaning there are 9 steps to run the test such as caller initiates the call, agent answers the call, agent keeps the call on hold and so on., the same applies to all the test cases.

The result of each test case is show under “status” field with three annotations pass, fail and not executed with respective colour coding. The “pass” field states the number of steps passed successfully or executed as expected. The ‘fail” field states the number of steps failed or not executed as expected. The “Not executed” field states how many test steps were not executed or out of scope for this project. The final test result is decided from the number of pass, fail test cases. The “comment” section provides the details of the issues/warnings.

All the test case folders under each test are self-explanatory such as “on hold”, “call flow” so on. Stat holiday folder has steps involved when the citizen calls the queue on a statutory holiday and the call is diverted to the stat holiday music once it hits the queue and stat holiday is yes. Message sets is the steps involved in each and every message which is played to the citizen when they call the queue such as welcome message, queue information message and so on. Post Interaction survey refers to the steps involved when citizen disconnects the call with the agent and the citizen is offered with the survey to understand the quality of the service provided. The term “Test case folder” refers to redirecting to respective test case folders based on the test component which are part of other areas of MAXIMUS Canada architecture, not related to the project but are tested to see if they are not affected due this integration.

As shown in Figure 22, there are number of tests failed in 1st cycle of Functional testing such as issue with no queuing music played, no survey is offered to the caller, issue with ID check application no opening and having access to the agent, issue with multiple webchat initiated at one time, not able to attach file or images through web chat as expected, issue with post call interaction survey with wrong survey messages and so on. All these issues are logged into star team and sent to respective teams for them to fix and re-tested in multiple cycles until no fail events are found with all pass test results as shown in figure 23. Few causes of these issues are improper routing of the call due to configuration, issue with network to load the ID check application, survey use case is not accessible due to improper network routing, not able to access multiple webchats at a time due to no media recourses available and so on. All these issues are addressed by collaborating with different teams and re-testing to confirm if it has been fixed.

Functional Test case			Status			Final Test result	Comments	
Test	Test components	Test case	Steps involved	Pass	Fail			Not Executed/Skip
Smoke Test of Channel Expansion	Video chat	Call flow	20	20	0	0	Pass	
		Message sets	15	15	0	0	Pass	
		Queuing	18	18	0	0	Pass	
		On Hold	9	9	0	1	Pass	Citizen hold is still in design
		In Business Hour, agent available	22	22	0	0	Pass	
		In Business Hour, agent not available	22	22	0	0	Pass	
		In Business Hour, agent not signed in	25	24	0	1	Pass	Out of office voice message is updated
		Out of Business Hours	21	21	0	0	Pass	
		Stat Holiday	18	18	0	0	Pass	
		Post Interaction Survey	23	23	0	0	Pass	
		Escalations	22	22	0	0	Pass	
		Camera & Agent settings	7	7	0	0	Pass	
		End-to-end testing	25	25	0	0	Pass	
		ID Check access and Verification	Auto-open browser to correct URL	6	6	0	0	Pass
			Agent login/logout through IDIR	4	4	0	0	Pass
			Access Request form	7	7	0	0	Pass
		Web chat	Call flow	21	21	0	0	Pass
			Message sets	15	15	0	0	Pass
			Queuing	19	19	0	0	Pass
			On Hold	9	9	0	0	Pass
			In Business Hour, agent available	23	23	0	0	Pass
			In Business Hour, agent not available	24	24	0	0	Pass
			In Business Hour, agent not signed in	25	24	0	0	Pass
Out of Business Hours	21		21	0	0	Pass		
Stat Holiday	18		18	0	0	Pass		
Post Interaction Survey	23		23	0	0	Pass		
Escalations	22		22	0	0	Pass		
Co-browse	Co-browse launch from website		4	4	0	0	Pass	
	Confirm short code accept/reject		6	6	0	0	Pass	
	Test each channel with co-browse	27	27	0	0	Pass		
Regression suite- End-to-End	ServiceBC	Test case folder	52	48	0	4	Pass	out of scope of this project
	HIBC	Test case folder	43	38	0	5	Pass	out of scope of this project
	SMS	Test case folder	21	19	0	2	Pass	out of scope of this project
	Pharmacare	Test case folder	20	15	0	5	Pass	out of scope of this project
	Pharmnet	Test case folder	18	12	0	6	Pass	out of scope of this project
	Fax	Test case folder	13	13	0	0	Pass	out of scope of this project
	Channel expansion	Test case folder	68	60	0	8	Pass	
	Agent Desktop	Finesse Home Page	Test case folder	16	16	0	0	
Agent Desktop	Video chat	Test case folder	15	15	0	0		
	web chat	Test case folder	17	17	0	0		
	Co-browse	Test case folder	19	16	0	3	In development	
	Supervisor Desktop	Home	Test case folder	18	18	0	0	
Supervisor Desktop	Interaction Activity	Test case folder	7	7	0	0		
	Monitoring Activities	Test case folder	6	6	0	0		
	Task Bar	Test case folder	11	11	0	0		
	Directory Actions	Test case folder	12	11	0	1	out of scope for this project	
	User Manger Actions	Test case folder	4	4	0	0		
	All Channels	Channel Priority	Test case folder	3	3	0	0	
	Time of Day and Holiday check	Test case folder	5	5	0	0		
	Inbound video chat/phone acceptance	Test case folder	7	7	0	0		
	Inbound call alert	Test case folder	3	3	0	0		
	Inbound call information display	Test case folder	5	5	0	0		
	Outbound call, SMS, Web chat	Test case folder	26	26	0	0		
	Hold/ Retrieve	Test case folder	7	7	0	0		
	All Channels	Conference scenarios	Test case folder	18	18	0	0	
Peripheral channel activities		Test case folder	14	14	0	0		
Shared group contact activities		Test case folder	12	7	0	5	out of scope for this project	
After hours voice mail		Test case folder	3	3	0	0		
Regression testing of voice		Test case folder	18	18	0	0		
Small regression execution		Test case folder	5	5	0	0		
Reporting		SBC supervisor dashboard	Test case folder	28	28	0	0	
Standard stock reports		Test case folder	7	7	0	0		
UWF stock reports		Test case folder	12	12	0	0		
Tephony & Performance reports		Test case folder	11	11	0	0		
Reporting	Omni-channel interaction reports	Test case folder	11	11	0	0		
	Knowledge base & Service Desk	Test case folder	16	16	0	0		

Figure 23: Functional testing Results – Final Cycle

4.5.5 Business Acceptance Testing

In this project, Business Acceptance Testing (BAT) is used to obtain confirmation that the system met the requirements specified. BAT is the final stages of a project to ensure that the incorporation of video Chat, web chat along with co-browse to existing architecture of ServiceBC at MAXIMUS Canada fulfills the business needs and satisfies the end customers/users using test cases based on testing the quality, delays, connection strength of the call. Acceptance testing will also cover off Usability – screen navigation/button response time, interaction latency (SMS, Video Chat, Web Chat, Co-browse), reporting response time, and video quality which is not covered in Functional testing. As part of BAT testing below tests are build and executed.

The initial results for all the test cases in Figure 24 shows that few tests are failed. All the failed events are tagged and logged into the star team and based on the cause for the fail, the defect is sent to respective team to fix it. After the defect is analyzed and fixed, the testing procedure is repeated again for all the test cases. This process of testing, logging the defects, fixing the issues and re-testing is continued until the final results for all the test cases are pass as shown in Figure 25.

Public Testing – public testing of the public end of the Call Flows is done in this testing.

1. Testing of the various Service BC channels, menus and call flows primarily to test the messages are correct for each flow and cadence is acceptable.
2. Formal testing of call flows through to Agents as prelaunch for Agent verification and validation of the Finesse Screens.
3. Verification report on Valid URL Links prior to production

Agent Testing – Agent testing will include the following:

1. Camera and Agent desk settings are working and within acceptable quality
2. Pickup of calls generated by public testers and verification and validation of the PCCE Finesse, Upstream, and SMS screen displays.
3. Verint Impact 360 Workforce Management – Verification and validation of screen displays and Adherence.
4. TelStrat Call Recording – Verification that all interactions are recorded (both screens and voice including Web Chat and Video Chat interactions that occur without a live phone call.
5. VoIP Telephone sets and headsets.
6. Agent VDI pool login
7. Access to ID Check system

Supervisors – Supervisor testing will include the following:

1. Monitoring Activities Validation

Schedulers – Work Force Management Scheduling

Business Acceptance Test case								
Test	Test components	Test case	Steps involved	Status			Final Test result	Comments
				Pass	Fail	Not Executed/Skip		
Public Testing	Call flows	Test folder	43	42	1	0	Pass	The hold music is incorrect
	URL Verification	Test folder	4	4	0	0	Pass	
	Menus available	Test folder	24	24	0	0	Pass	
	Call back verification	Test folder	7	7	0	0	Pass	
Agent Testing	Camera & Display verification	Test folder	6	6	0	0	Pass	
	Call answer of different call flows	Test folder	51	45	0	6	Pass	Out of scope of the project
	Screen updates on call	Test folder	6	6	0	0	Pass	
	Agent status	Test folder	19	19	0	0	Pass	
	Verint WFM screen verification	Test folder	6	6	0	0	Pass	
	Telstrat Call recording	Test folder	9	7	2	0	Pass	Recording was delayed
	VOIP telephony	Test folder	4	4	0	0	Pass	
	VDI login/logout	Test folder	4	4	0	0	Pass	
Supervisor	ID check login verification	Test folder	5	5	0	0	Pass	
	Monitoring Activities	Test folder	13	13	0	0	Pass	
Scheduler	WFM Scheduling	Test folder	4	4	0	0	Pass	

Figure 24: BAT Testing results – 1st cycle

The field “test” shows the main folder under functional testing involving the test components. Each test component is built with number of test cases with each test case having number of steps involved with them. The field under “steps involved” provides the number of steps involved under each test case for example steps involved in “URL Verification” is 4 meaning it has four steps to execute this test case such as copy URL, click enter, opening URL, checking if correct webpage is opened, the same applies to all the test cases.

The result of each test case is show under “status” field with three annotations pass, fail and not executed with respective colour coding. The “pass” field states the number of steps passed successfully or executed as expected. The ‘fail’ field states the number of steps failed or not executed as expected. The “Not executed” field states how many test steps were not executed or out of scope for this project. The final test result is decided from the number of pass, fail test cases. The “comment” section provides the details of the issues/warnings.

The term “Test folder” refers to redirecting to respective test case folders based on the test component. Each test folder is executed based on the test component. For example, the test component “Menus available” means what all menus are available for the caller when they first called to the queue. “Call back verification” means testing the call back feature and testing the folder related to that. The same applies to all the folders.

As shown in Figure 24, there are number of tests failed in 1st cycle of BAT testing such as issue with recording, issues with Hold music playing incorrectly and so on. All these issues are logged into star team and sent to respective teams for them to fix and re-tested in multiple cycles until no fail events are found with all pass test results as shown in figure 25. Few causes of these issues are ports for recording are not open for recording no incoming streams are seen in the logs, uploading wrong hold music audio file for the integrated unit and so on. All these issues are addressed by collaborating with different teams and re-testing to confirm if it has been fixed.

Business Acceptance Test case								
Test	Test components	Test case	Steps involved	Status			Final Test result	Comments
				Pass	Fail	Not Executed/Skip		
Public Testing	Call flows	Test folder	43	42	1	0	Pass	The hold music is incorrect
	URL Verification	Test folder	4	4	0	0	Pass	
	Menus available	Test folder	24	24	0	0	Pass	
	Call back verification	Test folder	7	7	0	0	Pass	
Agent Testing	Camera & Display verification	Test folder	6	6	0	0	Pass	
	Call answer of different call flows	Test folder	51	45	0	6	Pass	Out of scope of the project
	Screen updates on call	Test folder	6	6	0	0	Pass	
	Agent status	Test folder	19	19	0	0	Pass	
	Verint WFM screen verification	Test folder	6	6	0	0	Pass	
	Telstrat Call recording	Test folder	9	9	0	0	Pass	
	VOIP telephony	Test folder	4	4	0	0	Pass	
	VDI login/logout	Test folder	4	4	0	0	Pass	
	ID check login verification	Test folder	5	5	0	0	Pass	
	Supervisor	Monitoring Activities	Test folder	13	13	0	0	Pass
Scheduler	WFM Scheduling	Test folder	4	4	0	0	Pass	

Figure 25: BAT testing Results – Final cycle

4.5.6 Test video chat between test citizen and a test agent

In this section, step by step process of test video chat initiated by test citizen to test agent accepting it, is detailed using screenshots. This feature can be initiated by any of the eligible BC residents from ServiceBC website or mobile application to have a virtual face-to-face interaction with agents which allows them to better explain their queries and quicker resolution. This test confirms that all the options mentioned in the initial requirements are met and successfully implemented.

1. Citizen initiates a Video Chat

Citizen navigates to MCAP site (<https://mcap-test.pathfinder.gov.bc.ca>) as depicted in Figure 26 and clicks on the View More button available under Video Chat option:

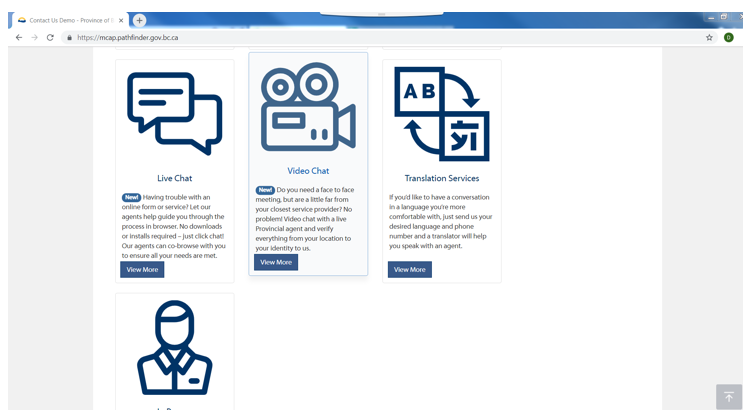


Figure 26: MCAP site (internal MAXIMUS site) used for testing

Once the Citizen clicks on the ‘View More’ available under Video Chat, a ‘Chat’ button will be displayed to the Citizen as shown in Figure 27:

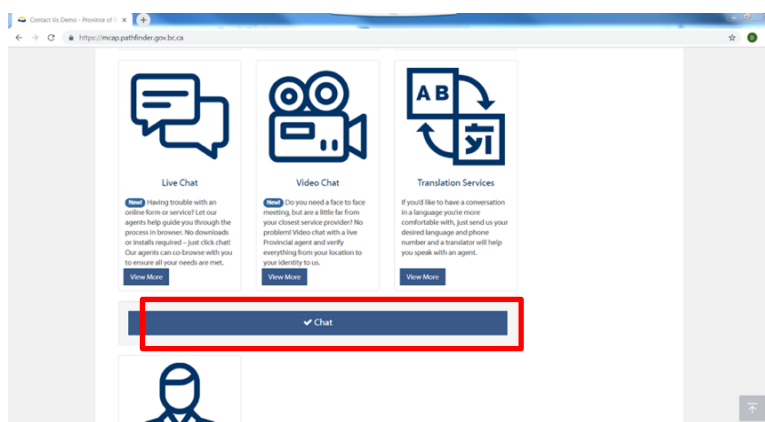


Figure 27: ‘Chat’ option under video chat channel

Once the Citizen clicks on the Chat button, the Video Chat request will be launched. The request is sent to the video chat queue of ServiceBC contact center at MAXIMUS Canada and will be accepted once a skilled agent is available. If there is no skilled agent available at that time and the request is in queue during business hours, the request will be maintained in the queue until an agent gets available. If there is no skilled agent available and it is non-business hours, then office message is played to the caller. Once an available agent accepts the video chat request, Agent and Citizen will be able to have both audio and video connection with one another.

In Figure 28, Agent Finesse desktop screen is shown where a test agent is having a live video chat with a test citizen. It also shows that, Agent Finesse desktop is popped with citizen's details such as phone number, type of calling etc. Agent is also provided with number of options such as full screen, mute, keypad, speaker, stop the video on the video chat window as shown.

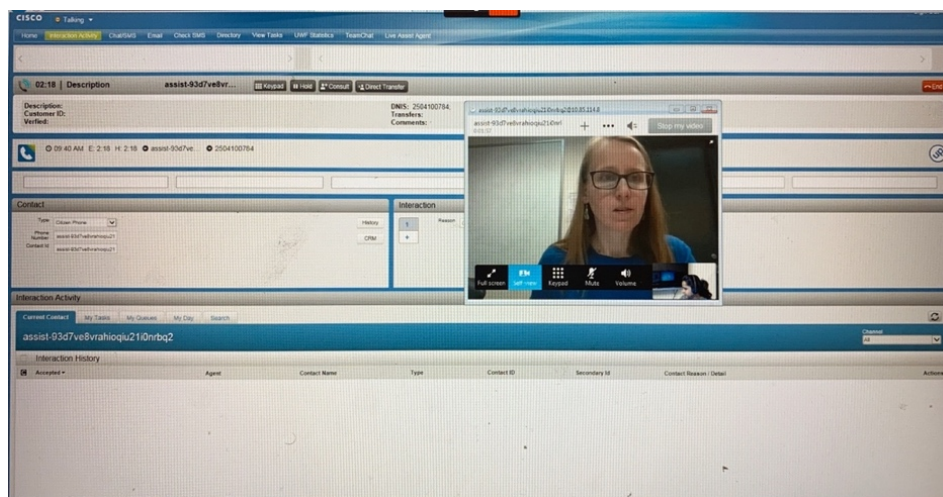


Figure 28: Agent screen showing live video chat with test citizen

In this process, Fusion web gateway of Cafe-X solution provides signalling conversion and Fusion Media server is responsible for the RTP. With the help of this feature residents can virtually connect face-to-face with ServiceBC agents to work through complex issues, queries and also validate their health cards remotely over a video call. It can be used by both Photo BC Services Card and Non-Photo BC Services card holders. This feature will not only reduce the processing time but also allows the residents to use their health card immediately after they are validated by one of the ServiceBC agents over the video chat.

4.5.7 Test web chat between test citizen and test agent

In this section, step by step process of test web chat initiated by test citizen to test agent accepting it is detailed using screenshots. This feature can be initiated by any of the eligible BC residents from ServiceBC website or mobile application to have a web

conversation with agents which allows them to share any documents/pictures, have track of all their texts to better explain their queries and faster resolution. This test confirms that all the options mentioned in the initial requirements are met and successfully implemented.

1. Citizen initiates a Web Chats

Citizen navigates to MCAP site (<https://mcap-test.pathfinder.gov.bc.ca>) as depicted in Figure 29 and clicks on the View More button available under Live Chat option:

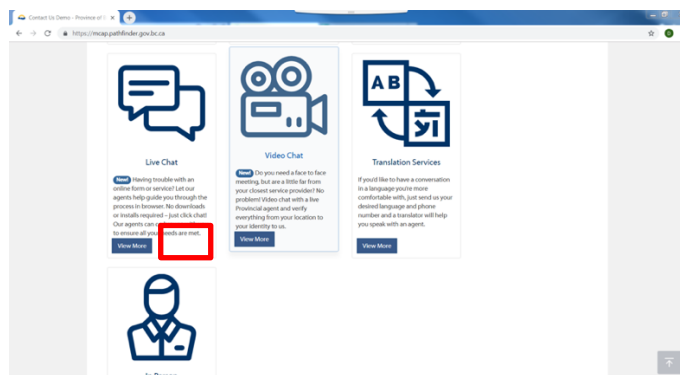


Figure 29: MCAP site (internal MAXIMUS site) used for testing

Once the Citizen clicks on the ‘View More’ available under Live Chat, a ‘Chat’ button will be displayed to the Citizen as shown in Figure 30:

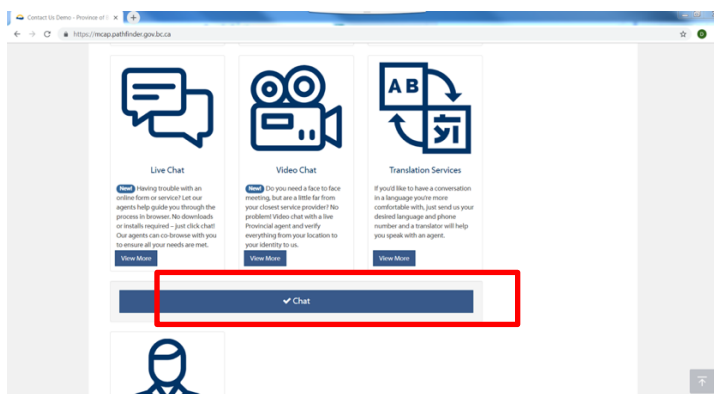


Figure 30: ‘Chat’ option under web chat channel

Once the Citizen clicks on the Chat button, the Web Chat launches in a new window and the Citizen receives the opening concierge. Once the contact centre agent accepts the Web Chat request, citizen and the agent will be able to exchange messages with one another as shown in Figure 31 and 32:

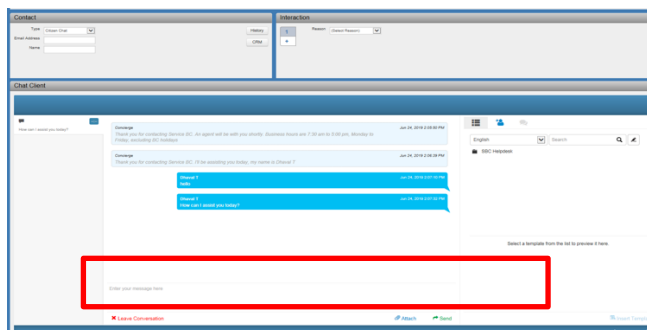


Figure 31: Web chat window on Agent side

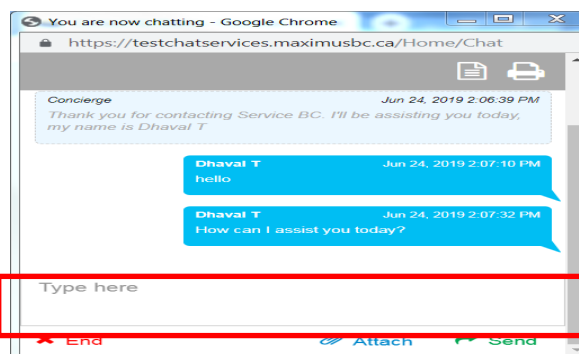


Figure 32: Web chat window on citizen side

In this process, Fusion web gateway of Cafe-X solution provides signalling conversion and Fusion Media server is responsible for the RTP. Web chat feature allows residents to connect with ServiceBC agents for quick and easy assistance with questions, services and share important documents/JPEG pictures for validation. Web chat feature will help in faster support, real-time text preview, instant customer feedback, low barrier, quicker resolutions, file/ photo transfer, collaborative support with other teams for multiple teams-oriented issues/ queries, increased efficiency and data security. It allows residents to request for a chat summary at the end of their chat to the agents for future reference. With the help of this feature, ServiceBC agents can assist multiple residents at once which helps in improving the productivity.

4.5.8 Test co-browse session between test citizen and test agent

In this section, step by step process of test co-browse initiated by test citizen to test agent accepting it is detailed using screenshots. Once the citizen requests for a co-browse session, a short code is popped up to the citizen. Once the agent enters this short code provided by the citizen over the phone, video call, web chat, text or email on the “Live assist” tab on their agent’s console window, agent will be able to see the citizen’s screen and have access to their current page. This test confirms that all the options mentioned in the initial requirements are met and successfully implemented.

In Figure 33, a sample co-browse session between agent and citizen is shown where agent is able to see citizen's current screen and access it with all the co-browse options.

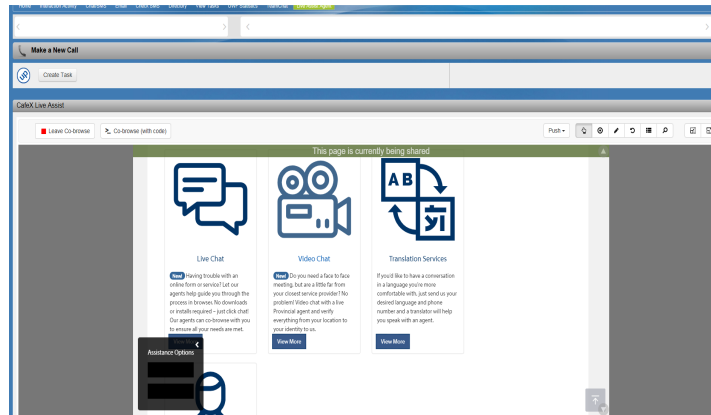


Figure 33: Co-browse tab on agent side showing citizen's window

4.5.9 Defect Tracking in StarTeam for Channel Expansion of ServiceBC

In this section, defect tracking for Channel expansion project of ServiceBC in StarTeam is shown in Figure 34. As shown, all the defects are logged in the tool based on the severity of the issue. Each issue is tagged with a CR Number which can be used to link the issue to respective test case number in SilkCentral used for testing. Each issue has a field “component” which describes the issue in brief. The “responsibility” field indicates which team/person needs to work on that issue or who is responsible to fix the issue. The “Status” field indicates what is the current status of the issue. “Modified by” indicates the person/team who have recently kept a note or modified anything in the issue. “Synopsis” field indicates the detailed description of the issue and also provides all the notes provided by each and every one who worked on that issue. “Entered by” field indicates who has created the issue.

Once a defect is logged into StarTeam, based on the issue the defect is assigned to respective team/person by entering the name in “Responsibility” field. Once the issue is saved with these details, the defect is assigned to them and an email notification is sent to them. The assigned team/person works on the issue by providing an update notes in “synopsis” field and once there is a change in status of the issue, it is stated in the ticket by changing the status field. The scenario where the defect is seen is re-tested for confirmation of whether it is fixed or not fixed or working as expected.

CR Number	Component	Responsibility	Status	Severity	Synopsis	Modified By	Modified Time	Entered By
17,285	Stabilization - Vid...	Darshan Dave	Deferred	Low	Testing SdkCentr...	Darshan Dave	06/20/2010 11:3...	Darshan Dave
17,751	Stabilization - Vid...	Dhaval tapkirwala	Is Duplicate	High	2019/01/18 JR: ...	Jonathan Lampert	01/18/2019 2:33...	Dhaval tapkirwala
17,746	Stabilization - Tel...	Janine Roy	Fixed	High	2019/01/25 JR: ...	Jonathan Lampert	01/29/2019 10:03...	Janine Roy
17,745	Stabilization - Co...	Dhaval tapkirwala	Open	Medium	2019/01/18 JR: C...	Jonathan Lampert	01/18/2019 2:31...	Dhaval tapkirwala
17,744	Stabilization - Co...	Janine Roy	Is Duplicate	Medium	2019/01/28 JR: ...	Jonathan Lampert	01/29/2019 4:20...	Dhaval tapkirwala
17,743	Stabilization - CO...	Jonathan Lampert	Fixed	Medium	201/01/16 JR: Tl...	Jonathan Lampert	01/16/2019 2:20...	Dhaval tapkirwala
17,729	Regression - Enta...	Priyani Vanaparthi	Fixed	Medium	2019/01/29 JR: ...	Jonathan Lampert	01/29/2019 10:0...	Priyani Vanapar
17,738	Deployment - We...	Jonathan Lampert	Is Duplicate	Low	2019/01/18 JR: T...	Jonathan Lampert	01/18/2019 2:41...	Priyani Vanapar
17,727	Deployment - Fin...	Nick Gordon	Fixed	Low	2019/01/22 JR: S...	Jonathan Lampert	01/22/2019 2:19...	Priyani Vanapar
17,736	Deployment - Fin...	Nick Gordon	Fixed	High	20190106 JR: T...	Janine Roy	01/06/2019 12:4...	Nick Gordon
17,725	Deployment - Vid...	Jonathan Lampert	Fixed	High	2019/01/16 JR: C...	Jonathan Lampert	01/16/2019 2:58...	Nick Gordon
17,724	Deployment - Ag...	Nick Gordon	Closed Fixed	Low	2019010308: Fk...	Janine Roy	01/03/2019 1:31...	Nick Gordon
17,733	Deployment - Co...	Nick Gordon	Closed Fixed	Low	2019010308: Fk...	Janine Roy	01/03/2019 1:35...	Nick Gordon
17,732	Deployment Regi...	Nick Gordon	Closed As Desl...	Low	2019010308: Kn...	Nick Gordon	01/03/2019 11:5...	Nick Gordon
17,731	Deployment - Co...	Nick Gordon	Closed Fixed	Medium	2019-01-05 JR: ...	Janine Roy	01/05/2019 11:37...	Nick Gordon
17,655	Channel Expansio...	Janine Roy	Fixed	Medium	2018-11-30 JR: ...	Janine Roy	11/30/2018 2:21...	Dhaval tapkirwala
17,650	Channel Expansio...	Jonathan Lampert	Open	High	2018-11-11 JR: ...	Janine Roy	01/11/2019 1:13...	Pradhep Reddy
17,666	Channel Expansio...	Dhaval tapkirwala	Closed Fixed	Low	2018-11-15PR:...	Dhaval tapkirwala	11/22/2018 12:2...	Dhaval tapkirwala
17,605	Web chat - Non fu...	Pradhep Reddy	Closed Cannot...	Medium	2018-11-14 JR: ...	Dhaval tapkirwala	11/22/2018 11:4...	Pradhep Reddy
17,604	Channel Expansio...	Dhaval tapkirwala	Closed As Desl...	Medium	2018-11-15PR:...	Dhaval tapkirwala	11/22/2018 10:5...	Dhaval tapkirwala
17,602	Channel Expansio...	Dhaval tapkirwala	Closed Fixed	Critical	14-nov-2018 PR:...	Dhaval tapkirwala	11/22/2018 12:11...	Dhaval tapkirwala
17,598	Channel Expansio...	Dhaval tapkirwala	Closed Fixed	Medium	2018-11-13 JR: ...	Dhaval tapkirwala	11/22/2018 12:0...	Dhaval tapkirwala
17,597	Channel Expansio...	Dhaval tapkirwala	Closed As Desl...	Medium	2018-11-14 JR: ...	Dhaval tapkirwala	11/22/2018 11:0...	Dhaval tapkirwala

Figure 34: Defect Tracking using StarTeam

As part of defect tracking process many defects incurred during different phases of testing and assigned to respective teams to fix it and re-test the scenario to confirm for the fix. Below are few examples of defects which occurred during testing,

4.5.9.1 Delay in Inbound emails during Regression testing:

During Regression testing performed during Deployment, it has been noticed that there is a delay in receiving inbound email notifications to the ServiceBC agents and a defect has been logged into the StarTeam as shown in Figure 35.

Change Request 17,739, Revision 1.6

Status: Fixed | Priority: No | Type: Defect

Severity: Medium | Platform: All

Component: Email - Deployment

Category: Code

Test Phase: Functional

Responsibility: Priyani Vanaparthi

Entered By: Priyani Vanaparthi

Synopsis: 2019/01/29 JL: Issue has ceased and was assumed to be derived from issues with email on govt side. Closing issue as fixed
20190106 JR: Check in with Government Messaging on Monday but it could have something to do with the DNS entry might be misconfigured. Check Monday. Have government check the logs.
20190105 JR: For the Service BC email boxes, Inbound Email are delayed and are arriving after 5-10 minutes

Figure 35 : Delay in Email notification

As seen in Figure 35, the status field indicates the current status of the defect, Severity indicates whether it is critical, High, medium or low based on the impact to the business because of this defect. Component indicates the title of the defect, Synopsis shows the details and updates on the defect as work is going on, Responsibility shows who is responsible to fix the defect, entered shows who has created the defect, test phase

shows which phase of testing this defect was logged, addressed in build shows which build the fix for this issue is included in the implementation and so on.

In this defect, there was a delay seen in the email notifications to the agents for inbound traffic. The logs from the client side i.e. ServiceBC has been requested to be checked and confirmed that the delay was caused due to already existing know delay from the client end. The issue has been re-tested after it has been fixed on client side and seen that the issue didn't exist and hence tagged to be fixed.

4.5.9.2 No results found when searching interaction activity with Agent Name:

While deploying video chat and as part of testing, the Agent Name is searched in the Interaction activity window on the Finesse desktop of the ServiceBC agent and it has been observed that there were no results found even though there were results related to it and hence a defect has been logged into the StarTeam as shown in Figure 36.

The status field indicates the current status of the defect, Severity indicates whether it is critical., High, medium or low based on the impact to the business because of this defect. Component indicates the title of the defect, Synopsis shows the details and updates on the defect as work is going on, Responsibility shows who is responsible to fix the defect, entered shows who has created the defect, test phase shows which phase of testing this defect was logged, addressed in build shows which build the fix for this issue is included in the implementation and so on.

Figure 36: No agent name in Interaction window search

In this defect, the infrastructure team was involved to check if there was any storage issue and confirmed that there was not any. The issue has then sent to TTEC team (the business partner for Finesse desktop provider) to check if the issue is related to the product version or compatibility with the current integration. It has been confirmed that there was a bug in the product version and hence been addressed in the upgraded patch from TTEC. The patch has been installed successful and retested to confirm the issue has been fixed.

4.5.9.3 On the agent co-browse window, default code is displayed every time when clicking on the "Co-Browse (with code) button":

While testing co-browse tool during functional testing, the short code window in the co-browse tab of the Agent does not disable after the first co-browse session and when the session is still running, it was observed that the window still shows the option to enter the short code which is not as expected as per the requirements and a defect has been logged into the StarTeam as shown in Figure 37.

The status field indicates the current status of the defect, Severity indicates whether it is critical., High, medium or low based on the impact to the business because of this defect. Component indicates the title of the defect, Synopsis shows the details and updates on the defect as work is going on, Responsibility shows who is responsible to fix the defect, entered shows who has created the defect, test phase shows which phase of testing this defect was logged, addressed in build shows which build the fix for this issue is included in the implementation and so on.

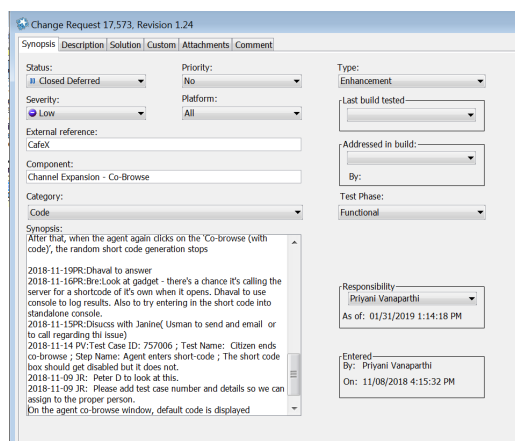


Figure 37: Short code window of co-browse does not disable as expected

In this defect, the TTEC team was involved to check if there was any issue on Finesse Desktop and the Cafe-X team was also involved to check if there is any issue with integration or in the product and it has been confirmed that it is working as expected and in current release this issue was logged in the TTEC team and it was deferred and closed as it is expected to release in future releases as per requirement.

4.5.9.4 TelStrat not capturing video recordings:

TelStrat which is the video capturing tool was not working as expected and the video recordings of the video chats was not captured. The issue was sent to the TTEC and TelStrat team to see if there was any issue on their end and defect has been logged as shown in Figure 38.

Change Request 17,746, Revision 1.5

Synopsis | Description | Solution | Custom | Attachments | Comment

Status: Fixed Priority: No Type: Requirement

Severity: High Platform: All Last build tested:

External reference:

Component: Stabilization - Telstrat not Capturing Video Recording

Category: Configuration-System

Synopsis:

2019/01/25 JL: Retested again after Telstrat update and video is being captured per the project requirements (approximately 1 capture / 5 seconds).

Barclay Taylor from QA validated the results, but states that the capture rate may not be adequate for QA -- to be determined, falls outside project scope

2019/01/18 JL: 2019/01/16 JL: Issue with T Tec and Telstrat 2019/01/16 JL: Dhaval and JL to retest today -- tests failed 2019/01/14 PC: Email from Jack: I do not think you need a meeting for this, did Alex fix the problem with the desktops? I do not see him on this thread so I have added him. I know that the new desktops were never tested and the fix that I did was temporary and not intended as the final fix. Until the desktop is working correctly you will not get consistent results. Here is what needs to happen. 11... Get the desktop to run the correct machine name when an

Addressed in build: Next Build

By: Jonathan Lampert

Test Phase: Functional

Responsibility: Janine Roy

As of: 01/29/2019 10:34:12 AM

Entered: Janine Roy

On: 01/14/2019 1:51:39 PM

Figure 38: TelStrat not capturing recordings

The status field indicates the current status of the defect, Severity indicates whether it is critical., High, medium or low based on the impact to the business because of this defect. Component indicates the title of the defect, Synopsis shows the details and updates on the defect as work is going on, Responsibility shows who is responsible to fix the defect, entered shows who has created the defect, test phase shows which phase of testing this defect was logged, addressed in build shows which build the fix for this issue is included in the implementation and so on.

After the detailed investigation with TTEC and TelStrat teams, it has been observed and confirmed that the issue found from TelStrat end for not able to record the video calls. TelStrat has fixed the video recording unit which went wrong and the issue scenario was retested to confirm that the issue has been resolved.

4.5.9.5 Contact type (on the Contact Panel) not getting populated automatically for Video Chat on Agent side:

It has been observed that the contact panel of the agent desktop is not being updated when there is an active video chat, after the video chat session and the defect has been logged as shown in Figure 39.

Change Request 17,529, Revision 1.7

Synopsis | Description | Solution | Custom | Attachments | Comment

Status: Closed Fixed Priority: No Type: Defect

Severity: Low Platform: All Last build tested:

External reference:

Component: Channel Expansion - Video Chat

Category: Configuration-System

Synopsis:

2018/11/13: Contact type is auto populating for Video and Web Chats.

2018/11/12 JR: Fixed. Please retest.

11/12 PC: Interaction History button is working now on both audio and video calls. On Video calls, interaction history may be empty because ANI (ContactId) changes on every video call.Video Chat - Contact panel - Contact type (on the Contact Panel) not getting populated automatically for Video Chat (the same is auto populated for audio calls)

11/9 PC: Piyush to get test number from Usman in Test environment. Working two weeks ago and now affecting other channels. Piyush got web chat working, need to test. Video Chat - Contact panel - Contact type (on the Contact Panel) not getting populated automatically for Video Chat (the same is auto populated for audio calls)

11/8 PC: Custom work required. Video Chat - Contact panel - Contact type (on the Contact Panel) not getting populated.

Addressed in build: Next Build

By: Janine Roy

Test Phase: Functional

Responsibility: Dhaval Tapkirwala

As of: 11/21/2018 7:06:42 PM

Entered: Dhaval tapkirwala

On: 11/06/2018 3:04:12 PM

Figure 39: Contact type not updated

The status field indicates the current status of the defect, Severity indicates whether it is critical., High, medium or low based on the impact to the business because of this defect. Component indicates the title of the defect, Synopsis shows the details and updates on the defect as work is going on, Responsibility shows who is responsible to fix the defect, entered shows who has created the defect, test phase shows which phase of testing this defect was logged, addressed in build shows which build the fix for this issue is included in the implementation and so on.

During the functional testing phase of channel expansion, it has been observed that the contact type on Finesse Agent’s desktop is not auto populated during a video chat where as it has been observed that it is populated during an audio call. The TTEC team and infrastructure team has been involved in this issue and it has been observed that as it could be empty for video chat as for a video chat the ANI changes on every video call which is not that of an audio call. This issue has been fixed with integration with TTEC and infrastructure and tagged as fixed and re-tested to confirm the same.

4.5.9.6 Supervisor “Live Assist” is not working

During the Regression testing of the components, it has been observed that Supervisor 'Live Assist' tab is not working as expected. An error message "Error HTTP status 401. This request requires HTTP authentication" is seen as part of accessing the Live assist window to the Supervisor and as a result the defect has been logged into the StarTeam as shown in Figure 40.

Figure 40: Supervisor “Live Assist” doesn’t work

The status field indicates the current status of the defect, Severity indicates whether it is critical., High, medium or low based on the impact to the business because of this defect. Component indicates the title of the defect, Synopsis shows the details and updates on the defect as work is going on, Responsibility shows who is responsible to fix the defect, entered shows who has created the defect, test phase shows which phase of testing this defect was logged, addressed in build shows which build the fix for this issue is included in the implementation and so on.

For this issue, the TTEC has been involved and checked for the possible issue with the supervisor account of the Finesse desktop and it was confirmed that there is no issue on TTEC. The Cafe-X team has been involved to check the issue from the Live assist side and it has been observed that there was configuration issue from supervisor option available. The configuration was fixed and the issue scenario was re-tested.

4.5.9.7 Incorrect Audio played when call is in queue:

When the Caller initiates a video chat and when they are queue, different queueing message is played instead of what is expected. It has been observed that the options are also different as expected on the phone. The issue has been logged in the StarTeam as shown in Figure 41.

Change Request 17,598, Revision 1.8

Synopsis | Description | Solution | Custom | Attachments | Comment

Status: Closed Fixed | Priority: No | Type: Defect

Severity: Medium | Platform: All | Last build tested:

External reference:

Component: Channel Expansion - Video Chat

Category: Code

Synopsis: The following message plays while the citizen is waiting in the queue. Our agents are assisting other clients. All calls are answered in the order in which they are received. Information and forms are available on our website. Please visit www.hilbc.gov.bc.ca for self-serve options. needs to be replaced with the following message: "Your call is very important to us. Please hold for the next available agent. All calls are answered in the order in which they are received"

2018-11-14 NG: Assigning to Dhaval, as he was working with Usman to get this fixed. Dhaval can you please provide Usman with the correct wav file name that we found for this?

2018-11-14 DT: The message name should be 'SHD_Q_ANS_IN_ORDER_HOLD' (pulled out from the test cases as this message is not available in our functional specifications)

Addressed in build: Next Build

By: Pradeep Reddy

Test Phase: Functional

Responsibility: Dhaval tapkirwala

As of: 11/22/2018 12:02:29 PM

Entered: By: Dhaval tapkirwala, On: 11/13/2018 10:28:39 AM

Figure 41: Incorrect Audio when call is in queue

The status field indicates the current status of the defect, Severity indicates whether it is critical., High, medium or low based on the impact to the business because of this defect. Component indicates the title of the defect, Synopsis shows the details and updates on the defect as work is going on, Responsibility shows who is responsible to fix the defect, entered shows who has created the defect, test phase shows which phase of testing this defect was logged, addressed in build shows which build the fix for this issue is included in the implementation and so on.

The defect has been assigned to the Infrastructure team to change the .wav file for that Audio during the queue for the right audio file. The infrastructure team has involved in this issue and fixed it by replacing the .wav file needed. The issue scenario has been replicated and re-tested to confirm that the issue was fixed.

With the help of this Chapter, the complete testing approach involved in this project is explained in detail which includes exploratory testing, integration testing, functional testing followed by Business Acceptance testing. In order to implement the enhanced features in production with live ServiceBC agents and citizens, all these tests need to be passed without any major issues and with least number of minor issues/warnings. It also provides the results from all the testing phases of this project showing test cases involved,

number of tests passed, failed or not executed along with sample video chat, web chat and co-browse session with test Agent and a test citizen involved.

This chapter also covers the steps followed in defect tracking process for this project with some examples which helps in tracking the defects found in each phase. This process helps in identifying the defects, fix the issue involved with that defect followed by re-testing for it to pass successfully. This chapter shows that all the requirements of this project were successfully implemented without any final major defects.

Chapter 5: Conclusion and Future Scope

5.1 Conclusion:

Healthcare is one of the crucial sectors controlled by government in Canada. In province of British Columbia, healthcare is provided for all its residents through BC Medical Services Plan (MSP). ServiceBC, which is British Columbia's central government organization for delivering government information and services to citizens plays a vital role in providing front line support for all the programs and services in healthcare sector. Currently, agents for ServiceBC at MAXIMUS Canada are using three modes of channels (phone, text and email) to communicate with BC residents for any of their healthcare related concerns. There are few major drawbacks observed with these channels such as, (1) BC residents had to visit there nearby ServiceBC office to activate there new MSP cards which may be a challenge for those living in remote locations and who may not be able to travel easily, (2) There can be delay in processing times and challenge of not receiving the health benefits until BC residents visit ServiceBC office to activate there health cards, (3) Residents may have difficulty in explaining their queries on phone/text/email to ServiceBC agents such as virtually asking about the form details they are filling or details which they are seeing on the website etc., (4) Residents will not be able to share any details to agents like images, files on phone/text/email leading them to manually visit ServiceBC office every time they need to. By using enhanced modes of communication video, web and co-browse these drawbacks can be addressed by allowing BC residents to better communicate with ServiceBC agents regarding there queries and also allow them to virtually validate their health cards hence reducing delay in receiving health benefits. These drawbacks are addressed using the enhanced modes of communication video chat, web chat and co-browse.

In this project, current modes of communication (phone, text and email) used by ServiceBC agents at MAXIMUS Canada are studied in detail and drawbacks involved with these are identified. For implementing enhanced channels, Cafe-X solution which needs to be integrated with existing architecture at MAXIMUS Canada was studied and understood in detail. This helps to configure, deploy and integrate video chat, web chat and co-browse functionalities with existing omni-channel contact center solution at MAXIMUS Canada.

Cafe-X SDKs enable context rich real-time communications within existing applications where as the Fusion Web gateway helps in removing signaling complexity between client app and SIP endpoints and plays a major role in signalling conversions. Fusion Media Broker is another important network component of Cafe-X which helps in converts and adapts media between external clients and enterprise devices; for inbound traffic, simplifies & limits RTP for legacy devices; for outbound traffic adds additional features for browser & mobile clients. With the help of Fusion Web gateway, the incoming HTTP traffic is converted to the SIP signalling to adapt to the SIP trucks of

ServiceBC infrastructure at MAXIMUS Canada. Once the end user i.e., a citizen/resident select an option for communicating on ServiceBC website the request is directed through the cafe-X solution where the Fusion web gateway helps in signalling conversion and Fusion Media Broker helps in providing the Media. The request is sent to the MAXIMUS contact center via SIP trunks and is placed to respective queue of ServiceBC agents. Once the request is in the queue, and there is an available ServiceBC agent it is held for their acceptance. Once the agent accepts the request the confirmation is sent to the citizen and there is a communication link established between them over a secured network using the reverse proxy server.

To implement enhanced channels video chat, web chat and co-browse, functional and non-functional requirements are gathered initially followed by detailed use cases for each channel as per the current call flow of ServiceBC. Once the UML flow are validated and finalized, test cases for each call flow including enhanced channels are built along with manually testing each and every feature on the client and agent side for all the channels. As part of functional testing, all the features web chat, video chat, ID check access and verification, co-browse, end-to-end testing, agent desktop, supervisor desktop, reporting and all other channels are tested followed by user acceptance testing for the entire system.

During the process of testing at all the phases, defects are tracked and acknowledged through defect tracking process in star team, a defect tracking tool. With the help of these step by step testing and defect tracking process the final system has been implemented without any major defects in the system. Test results showing the website of ServiceBC with enhanced channels along with the channel interfaces of video chat, web chat and co-browse are shown along with end-to-end channel interface between agent and end user (test resident).

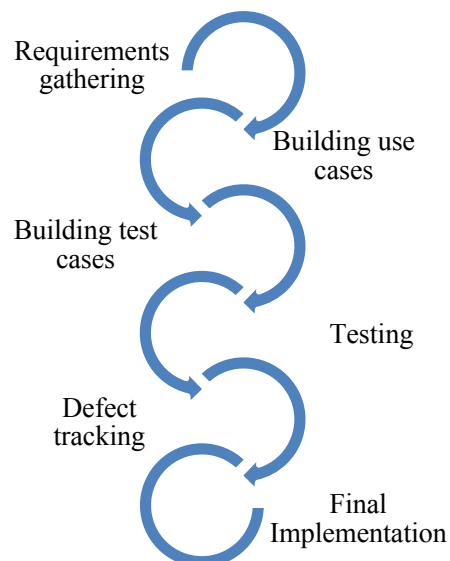


Figure 42: Steps involved in project implementation

As shown in Figure 42, the project implementation is done using several steps beginning with requirements gathering where all the business, functional and non-functional requirements are gathered in order to build a project to satisfy all of the client's requirements. While building the requirements, it is always recommended to consider all the software and hardware limitations of the architecture to understand the compatibilities and limitations of the requirements. The next step is to build UML diagrams based on the requirements. Usually while building UML diagram, always all the options involved in every step are considered and analyzed. These use cases are useful for both clients and the builders to easily understand the overall call flows involved in the project. The next step is to build test cases based on the UML diagrams in order to test and validate all the requirements mentioned.

After building the required test cases, the next step is to test all individual features along with the entire system using the testing process mentioned in the testing chapter. Once the testing of the entire unit is performed, all the defects incurred in the process of testing are logged and addressed using the defect tracking process. In this process, after all the defects are addressed and fixed, the test scenarios involved with those defects are re-tested in order to confirm that the defects have been fixed successfully. Once all the testing is done with all the results as "pass" in both test and development environment, the integrated system is implemented successfully in production. In this project, the video chat feature is implemented in production and web chat, co-browse features are considered to future scope for production phase.

With the help of these extended features, BC residents can validate their health cards more quickly and use them immediately without any delay in processing or travel times and have an opportunity to prefer their most convenient means of communication, with continuity and consistency across channels to ensure that their journey remain seamless.

As we know, customer service is an important sector in each and every organization in current society and it plays a major role in organization's growth, a company is always known with its customer service ratings. These enhanced features video chat, web chat and co-browse can not only be implemented and used for this particular project but also in all other sectors where customer service is involved. With the help of these enhanced features customer service agents of any company will be able to understand customer's queries or concerns more precisely and will be able to give quicker resolution than usual.

As these are easy to implement in any environment and can be integrated with the existing architecture using cafe-x solution which is also compatible with most of the environments, it allows any organization to easily incorporate these additional features. In this project these features are used for ServiceBC which controls most of the front-line support for healthcare of British Columbia, further these can be implemented by other companies where video chat, web chat and co-browse sharing tool will help for better understanding of end users. A complete architecture view of ServiceBC contact center at MAXIMUS Canada is shown in figure 43, as we can see the new enhanced features are incorporated into the existing architecture using Cafe-x solution (Fusion gateway and media broker) without affecting other parts.

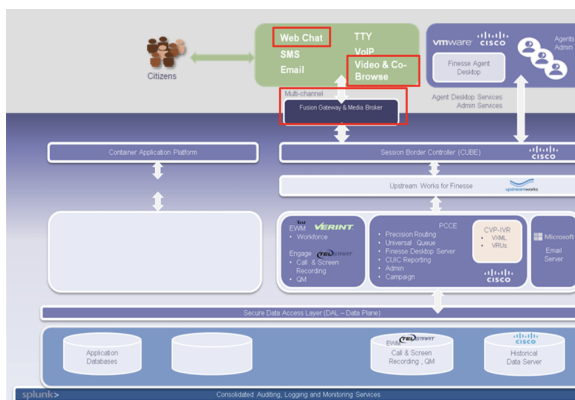


Figure 43: ServiceBC Contact Center Architecture overview at MAXIMUS Canada

5.2 Future Scope:

In this section, future work of the project has been discussed briefly such as extending number of channels in parallel for one ServiceBC agent at a given time, increasing number of ServiceBC agents skilled on enhanced channels, increasing the options available for web chat example currently only jpeg/jpg/pdf format files can be attached over web chat, extending this to many other formats.

1. As part of this project, Video chat, Web chat and Co-browse features are tested and implemented in test, development environment successfully. Video chat feature is successfully tested and implemented in production environment whereas Web chat and Co-browse features are to be implemented in production in future.
2. Currently, as part of this project with available infrastructure at MAXIMUS Canada (number of SIP trunks) a maximum of three web chats can be handled by a ServiceBC agent at a given time along with at max of one video chat/phone, one co-browse, three texts or as many as email requests. This can be increased by improving the infrastructure requirements at MAXIMUS Canada and increasing the SIP trunks at the site.
3. Currently, as part of this project with available infrastructure at MAXIMUS Canada (number of SIP trunks) a maximum of one co-browse session can be handled by a ServiceBC agent at a given time along with at max of one video chat/phone, three web chats, three texts or as many as email requests. This can be increased by improving the infrastructure requirements at MAXIMUS Canada and increasing the SIP trunks at the site.
4. At present, only three agents are skilled to take the enhanced channel requests at MAXIMUS Canada contact center, in future this number can be extended by preparing more agents skilled on this application features and knowledge base.
5. At present, in web chat feature either agent or citizen will be able to share the document over the live chat which is either in jpeg/jpg or pdf formats and all other formats are not supported due to software limitation. This can improve by collaborating with other software or applications in order to support files of all formats to increase flexibility to citizens/agents.

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Appendix A

In this section, the troubleshooting and addressing issues during deployment of CafeX solution with the existing MAXIMUS Canada contact center are discussed in detail.

Troubleshooting and Addressing issues:

1. iOS 9 and Xcode 7

Below issue is faced while using iOS 9 and Xcode 7 with some of CafeX iOS applications,

SSL Exception and Bitcode

ATP (App Transport Security), introduced with iOS 9 SDK / Xcode 7, is disabling all non-secure transport. If the application is connecting to an FCSDK or Live Assist server over HTTP, or HTTPS without a valid certificate, it is getting blocked and the console is reporting the error. In order to resolve this, we had to rebuild the application with changes to the build configuration in Xcode7:

1. Disable the generation of Bitcode
Enable Bitcode = NO.
2. Add entries to the application's plist file to disable the new iOS 9 Application Transport Security feature.

The following plist entries disable ATS quite broadly, for testing purposes:

```
<key>NSAppTransportSecurity</key>  
<dict>  
<key>NSAllowsArbitraryLoads</key><true/>  
</dict>
```

2. Install an Existing Untrusted Application

While having an installed application which was built with Xcode 6 and uses a non-secure HTTP connection, iOS is showing a message that the developer is untrusted as shown in figure 44.

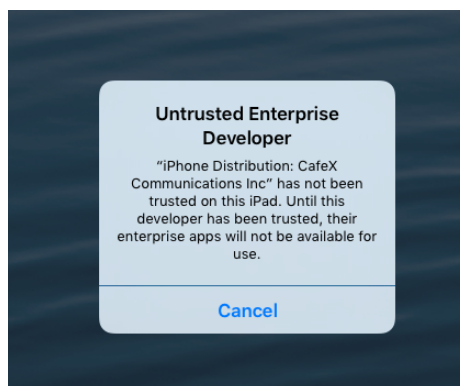


Figure 44: Untrusted Enterprise Developer error

This issue has been resolved by going to Settings->General->profiles, and explicitly trusting the developer as shown in figure 45.

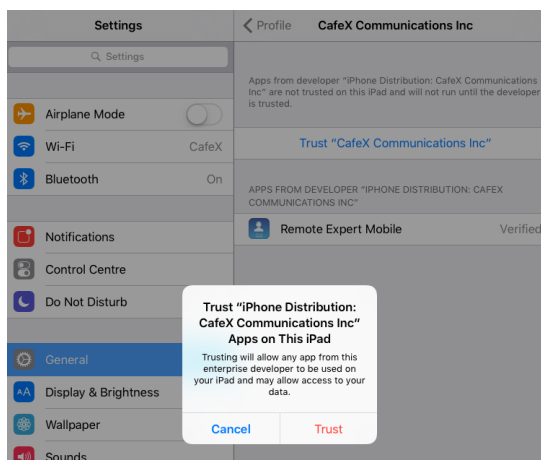


Figure 45: Trusting developer

3. CafeX Demo Apps Fail to download to iOS 9 Devices

Sometimes existing applications fail to download. This may be due to changes in the *plist* format. A workaround for this issue is:

1. Download the ipa file to a laptop.
2. Add it to iTunes under the Apps folder.
3. Transfer it to the device.

4. FAS Startup Issues

FAS sometimes fail to start. This may be due to an existing FAS process not having shut down properly. Below are the few steps which are done in order to fix the same,

Ensure FAS processes are not running:

```
# ps -aef | grep java
root 14103 11144 0 06:59 pts/0 00:00:00 grep java
```

The response above indicates that there are no Java processes running.

If the response indicates that there are Java processes running, we can shut them down with:

```
# service fas stop
# service fusion_media_broker stop
```

If they still show up in the output of `ps -aef | grep java` as above, we can shut them down by noting the process ID from the above command, and killing the process:

```
# kill -9 <PID>
```

or

```
# kill -9 `ps -ef | grep '[P]rocess Controller' | awk '{print $2}'`
```

The second form specifically looks for and kills the Process Controller process. It will not remove Media Broker processes.

5. Verifying Multicast Support

The FCSDK in multicast mode uses multicast and JGroups to share state between the nodes of a cluster. The master and slave nodes join a group using multicast, and use that group to share configuration changes. If a configuration seems to vanish from the Web Plugin Framework, or if calls fail randomly, this a multicast problem. If there is a multicast problem on the network, master and slave cannot discover each other, and therefore cannot synchronize configurations. The problem may be caused by some switches or routers having multicast turned off. The multicast problems are identified by generating multicast packets and exchanging them between CafeX elements. The multicast packets are generated using “iperf”.

To test multicast between a master and slave node below steps are executed:

1. Run the iperf server on the slave node:

```
# iperf -s -u -p 7600 -B 224.0.75.75 -i 1
```

```
-----
Server listening on UDP port 7600
Binding to local address 224.0.75.75
```

2. Run the iperf client on the master:

```
# iperf -c 224.0.75.75 -p 7600 -u -T 32 -i 1
```

```
-----
Client connecting to 224.0.75.75, UDP port 7600
Sending 1470 byte datagrams
Setting multicast TTL to 32
UDP buffer size: 224 Kbyte (default)
-----
```

Followed by:

```
[ 3] local 192.168.9.34 port 54654 connected with 224.0.75.75 port 7600
[ ID] Interval Transfer Bandwidth
[ 3] 0.0- 1.0 sec 129 Kbytes 1.06 Mbits/sec
[ 3] 1.0- 2.0 sec 128 Kbytes 1.05 Mbits/sec
(...)
[ 3] 0.0-10.0 sec 1.25 MBytes 1.05 Mbits/sec
[ 3] Sent 893 datagrams
as it starts to send datagrams.
```

3. Then the slave starts to receive multicast packets:

```
Joining multicast group 224.0.75.75
Receiving 1470 byte datagrams UDP buffer size: 224 Kbyte (default)
```

```
-----
[ 3] local 224.0.75.75 port 7600 connected with 192.168.9.34 port 54654
```

```
[ ID] Interval Transfer Bandwidth Jitter Lost/Total Datagrams
[ 3] 0.0- 1.0 sec 128 Kbytes 1.05 Mbits/sec 0.054 ms 0/ 89 (0%)
(...)
[ 3] 0.0-10.0 sec 1.25 MBytes 1.05 Mbits/sec 0.067 ms 0/ 893 (0%)
```

If there is no traffic flowing between the two nodes, we need to verify multicast connectivity and firewall configurations.

6. Verifying TMMBR

TMMBR is a protocol implemented by browsers as an extension in RTCP [25], it runs between two clients to negotiate video bandwidth dynamically during a call. If network conditions are poor, TMMBR will attempt to negotiate a lower bitrate to allow the video to flow through the network with less contention. A choppy, stutter, frozen-framed video in an H264 passthrough call between an FCSDK client and a desk phone could be because TMMBR hasn't been negotiated, or there are issues in the implementation of TMMBR.

If TMMBR is not negotiated, the SIP trunk will use a default bandwidth for the call. In a passthrough call the WebRTC leg will use the same bitrate, and may struggle with very high bandwidth, causing packet loss or high jitter. We can verify TMMBR is being negotiated by checking an SDP answer coming from a SIP trunk. The SDP is in the calls logged in the calls.log of the FAS that processed the call. If the SDP does not have TMMBR negotiated:

```
m=video 28558 RTP/AVP 97
b=TIAS:3936000
a=label:11
a=rtpmap:97 H264/90000
a=fmtp:97          profile-level-id=428016;packetization-mode=0;max-
mbps=267300;maxfs=
8910;max-rcmd-nalu-size=256000;level-asymmetry-allowed=1;max-fps=6000
a=imageattr:97 recv [x=1920,y=1080,q=0.60] [x=1280,y=720,q=0.50]
a=content:main
a=rtcp-fb:* ccm fir a=trafficclass:conversational.video.avconf.aq:admitted
```

If TMMBR has been negotiated, the SDP will look like:

```
m=video 29774 RTP/AVP 97
b=TIAS:3936000
a=label:11
a=rtpmap:97 H264/90000
a=fmtp:97          profile-level-id=428016;packetization-mode=0;max-
mbps=267300;maxfs=
8910;max-rcmd-nalu-size=256000;level-asymmetry-allowed=1;max-fps=6000
a=imageattr:97 recv [x=1920,y=1080,q=0.60] [x=1280,y=720,q=0.50]
```

```

a=content:main
a=rtcp-fb:* ccm fir
a=rtcp-fb:* nack pli
a=rtcp-fb:* ccm tmmbr
a=trafficclass:conversational.video.avconf.aq:admitted

```

Sometimes, devices may appear not to offer TMMBR. This appears to be a bug in the SIP trunk or device. We have found that changing the priority of video codecs allows the endpoint to negotiate TMMBR. The priority of video codecs is configured in the Web Plugin Framework:

1. Open a new web browser and navigate to the Web Admin UI (https://<fas_address>:8443/web_plugin_framework/webcontroller)
2. Click the Gateway, and then the Media Configuration, tab, and scroll down to the Codec Prioritization section as shown in figure 34:

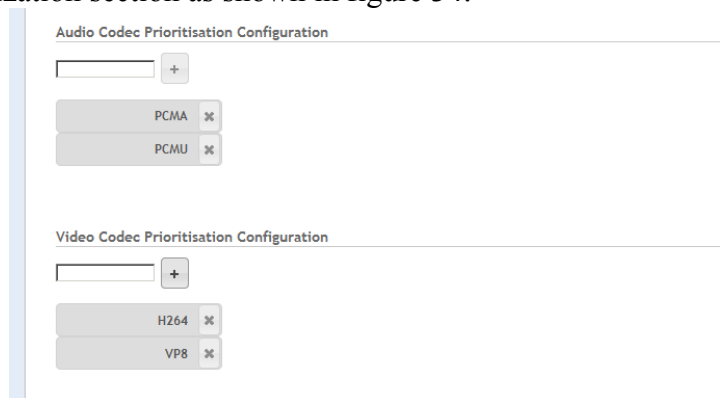


Figure 46: Media Configuration

3. Reorder the video codecs by dragging and dropping them into the order you want.

7. Call Connects without Video or Audio

One of the common cause observed for a call connecting without media is that the clients are unable to set up the path to the Media Broker. Possible causes for this are, Media Broker configuration issues:

1. The CIDR IP addresses
2. The SIP Network CIDR setting may be configured as all, but there are distinct interfaces for internal and external traffic.
3. The IP address configured on WebRTC [20] Local Address is either wrong or misconfigured (for instance, it cannot be 127.0.0.1).
4. There is no Media Broker configured to service the call.

A firewall is blocking the media path:

1. The WebRTC Public Port (which defaults to 16000) is not open on all firewalls between the client and the Media Broker.
2. The firewall is not configured to forward from WebRTC Public Address and Port to the Local Address and Port.

A VPN is blocking the media path:

1. If a VPN is not configured to allow two ways UDP [26], clients connecting by that VPN may experience no voice or video.
2. There has been seen some problem with STUN [27] responses. When a pcap trace shows no STUN responses to incoming STUN requests from a client connecting on a VPN, figure 47 shows no STUN messages leaving the Gateway in a Wireshark trace:

No.	Time	Source	Destination	Protocol	Length	Info	Successful Stun Req/Res
89	5.925621	10.60.1.113	10.255.32.144	STUN	152	Binding Request user: 44RTgkTn:LpCCZ/KVIUACHNCE	
90	5.928016	10.255.32.144	10.60.1.113	STUN	148	Binding Request user: LpCCZ/KVIUACHNCE:44RTgkTn	
91	5.928143	10.255.32.144	10.60.1.113	STUN	108	Binding Success Response XOR-MAPPED-ADDRESS: 10.60.1.113:60754	
92	5.929624	10.60.1.113	10.255.32.144	STUN	108	Binding Success Response XOR-MAPPED-ADDRESS: 10.255.32.144:16000	
168	6.405492	10.60.1.113	10.255.32.144	STUN	152	Binding Request user: 44RTgkTn:LpCCZ/KVIUACHNCE	
169	6.407412	10.255.32.144	10.60.1.113	STUN	148	Binding Request user: LpCCZ/KVIUACHNCE:44RTgkTn	
170	6.407471	10.255.32.144	10.60.1.113	STUN	108	Binding Success Response XOR-MAPPED-ADDRESS: 10.60.1.113:60754	
171	6.408937	10.60.1.113	10.255.32.144	STUN	108	Binding Success Response XOR-MAPPED-ADDRESS: 10.255.32.144:16000	
180	6.465837	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	No response to Stun Request
207	6.597942	172.29.14.5	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
211	6.621309	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
233	6.740700	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
237	6.758382	172.29.14.5	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
251	6.841909	172.29.14.5	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
253	6.851792	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
260	6.885773	10.60.1.113	10.255.32.144	STUN	152	Binding Request user: 44RTgkTn:LpCCZ/KVIUACHNCE	
261	6.888102	10.255.32.144	10.60.1.113	STUN	148	Binding Request user: LpCCZ/KVIUACHNCE:44RTgkTn	
262	6.888196	10.255.32.144	10.60.1.113	STUN	108	Binding Success Response XOR-MAPPED-ADDRESS: 10.60.1.113:60754	
263	6.891316	10.60.1.113	10.255.32.144	STUN	108	Binding Success Response XOR-MAPPED-ADDRESS: 10.255.32.144:16000	
274	6.950267	172.29.14.5	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
287	7.013551	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
298	7.084711	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
299	7.085751	172.29.14.5	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
315	7.163312	172.29.14.5	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
319	7.181983	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
337	7.263309	172.29.14.5	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	
343	7.314065	172.31.1.171	10.255.32.144	STUN	152	Binding Request user: 44RTgkTl:HXMjU1UM3dL5gZ7i	

Figure 47: No STUN messages leaving Gateway

In some cases, if multiple Media Broker instances are running, this has caused media problems. To see if multiple instances are running, we can run:

```
ps -eaf | grep rtp-proxy
```

If the response shows that more than one process is running, stop or kill both processes, and restart the service:

```
service fusion_media_broker restart
```

When multiple Media Brokers are interfering with each other, we will see STUN Binding Requests in a packet capture, but the Media Broker will not process them.