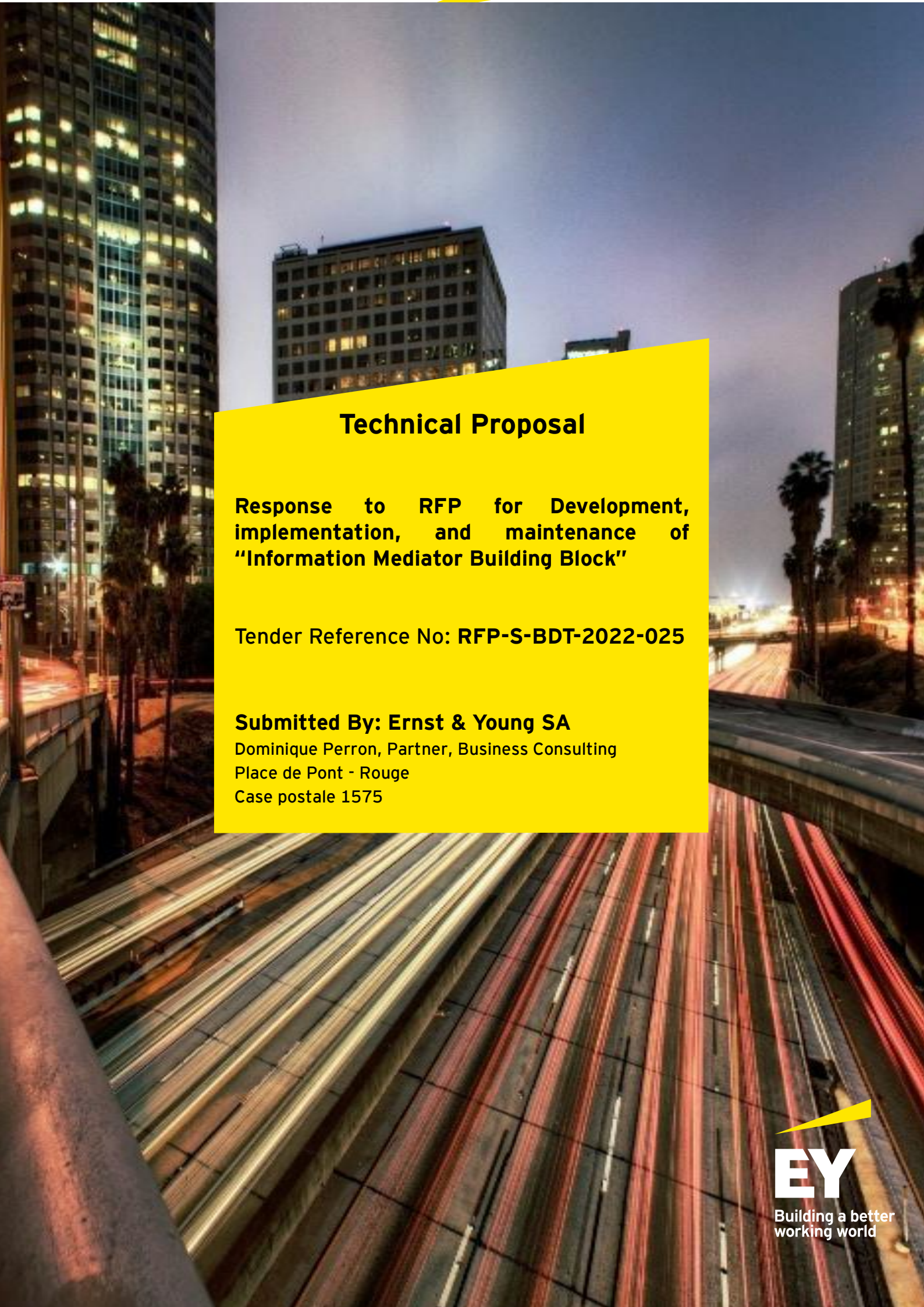


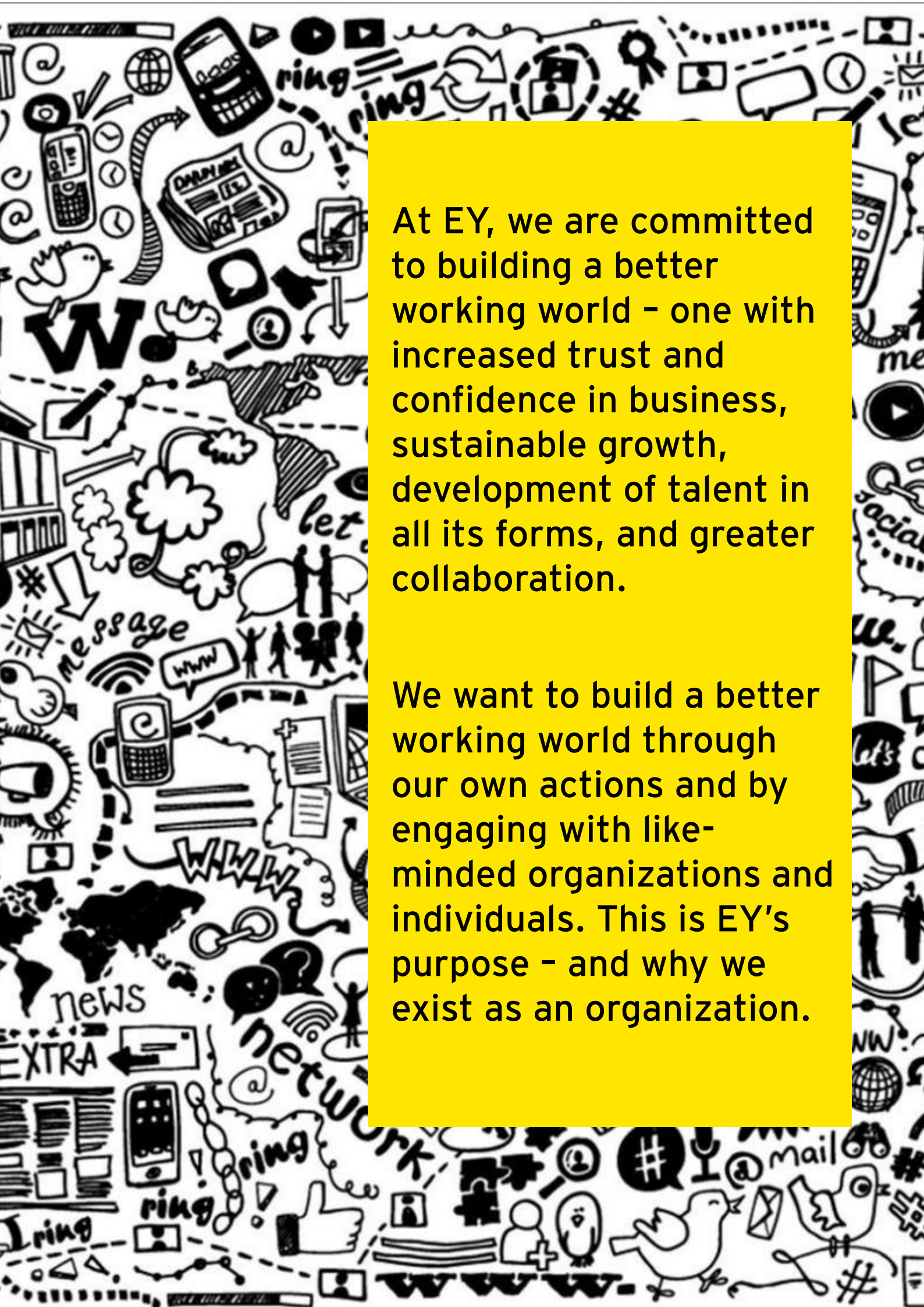
Technical Proposal

Response to RFP for Development, implementation, and maintenance of "Information Mediator Building Block"

Tender Reference No: **RFP-S-BDT-2022-025**

Submitted By: Ernst & Young SA
Dominique Perron, Partner, Business Consulting
Place de Pont - Rouge
Case postale 1575

EY
Building a better working world



At EY, we are committed to building a better working world – one with increased trust and confidence in business, sustainable growth, development of talent in all its forms, and greater collaboration.

We want to build a better working world through our own actions and by engaging with like-minded organizations and individuals. This is EY's purpose – and why we exist as an organization.

Contact Information

All communications with respect to this proposal may be addressed to:

Primary Contact-1			
Name	Dominique Perron Partner, Business Consulting		
Address	Ernst & Young SA Place de Pont - Rouge Case postale 1575 1211 Geneve 26		
Telephone	+41 58 2865899	Mobile	+41 793731843
E-mail	dominique.perron@ch.ey.com	Website	www.ey.com/ch

Primary Contact-2			
Name	Axel Timm Partner, Technology Consulting		
Address	Ernst & Young SA Place de Pont - Rouge Case postale 1575 1211 Geneve 26		
Telephone	+41 58 2863371	Mobile	+41 79 4477015
E-mail	axel.timm@ey.com	Website	www.ey.com/ch

Secondary Contact			
Name	**Milan Narendra** Partner, Consulting		
Address	Ernst and Young LLP 6th floor, Wing A & B, Worldmark 1, Aero city (IGI Airport) New Delhi-110037		
Telephone	+91-120 671 7000	Telephone	+91-120 671 7000
E-mail	Milan.Narendra@in.ey.com	E-mail	Milan.Narendra@in.ey.com

Disclaimer

This document contains confidential material proprietary to Ernst & Young SA ("EY"). The tools, material, ideas and concepts contained herein are proprietary and are to be used solely and exclusively to demonstrate the capabilities of EY for Request for Proposal RFP-S-BDT-2022-025 for Development, implementation, and maintenance of "Information Mediator Building Block" for ITU. The contents of this document are intended for the use of ITU and may not be distributed to third parties. This document does not constitute an agreement between EY and ITU. Any services EY may provide to ITU will be governed by the terms of a separate written agreement signed by ITU and EY. This document is based on information provided to us by ITU, which we have not verified. Accordingly, we are not responsible for any inaccuracies in that information. Furthermore, changes in ITU's definition of requirements will necessarily affect the document set forth herein. If ITU decides not to proceed with the project, selects another consulting firm, or decides to conduct the project itself, we request return of any printed copies of this document together with an assurance that no photocopies of this document have been made.

Confidentiality Statement

The information contained in this document includes descriptions of methodologies and concepts derived through substantial research and development efforts and contains trade secrets and other confidential or proprietary information of Ernst & Young SA, the disclosure of which would offer substantial benefit to competitors offering similar services. As a result, this proposal document may not be disclosed, used or duplicated - in whole or in part - for any purpose other than for the evaluation by the receiver for the process of awarding a contract.

Table of Contents

1. Technical Bid Cover Letter

Ernst & Young SA
Place de Pont - Rouge
Case Postale 1575
1211 Geneve 26

Tel: +41 (0)58 286 85 85
Fax: +41 (0)58 286 86 00
ey.com

18th Aug-2022

To,
Zoran Cikic (Head Procurement Division)
International Telecommunication Union

Subject: Submission of response for **Request for Proposal RFP-S-BDT-2022-025**

Dear Sir,

This is to notify that our company is submitting technical bid in response to Tender No **RFP-S-BDT-2022-025** for the Development, implementation, and maintenance of a "Information Mediator Building Block". Primary & Secondary contact for our company are as follows:

EY SA	Primary Contact	Secondary Contact
Name	Dominique Perron	Axel Timm
Title	Partner, Business Consulting	Partner, Technology Consulting
Phone	+41 58 2865899	+41 58 2863371
E-mail	dominique.perron@ch.ey.com	axel.timm@ey.com

We have brought together EY consultants across our global network who have extensive experience implementating projects of similar nature & complexity for responding to this RFP. To optimize overall costing of the proposal, we have proposed onsite /offshore model for overall delivery of this project.

We would like to emphasize our keen interest in building a long-term relationship with ITU.
If you have any questions related to this document or its enclosures, please do not hesitate to contact us.

Yours sincerely,
On behalf of Ernst & Young SA

Dominique Perron
Partner, Business Consulting

Place: Geneve

Date: 18th August-2022

1.1. Checklist of Documents

S. No.	Items	Reference Section
1.	Detailed Description of Requirements" section provided in Annex V"	5.2.5
2.	Information Mediator Building Block proposed solution:	5.2
	a. Describe the extent by which the delivered solution will cover (or not) the functionalities and requirements as per the GovStack Information Mediator Building Block Specifications document described in Annex V-A.	5.2.5
	b. Describes the customization that will be implemented if using an already existing product/solution.	NA
	c. Describe the development of any additional requirements/functionalities that are required but missing in the GovStack Specs document including Open API specifications.	5.2.6
	d. Describe technologies used and the extent to which the proposed solution adopts Open-Source and other relevant good technical practices such "Microservices architecture", the use of docker files and containers for scalability and re-usability, etc.	5.2.4
3.	Project implementation and resource deployment plans based on an agile methodology.	5.3
4.	Proposed time schedule for all the activities and deliverables.	5.4
5.	Project management and monitoring approach for the project.	5.5
6.	Risk Management Plan	5.6.3
7.	Exit Management Plan	5.6.4

Ernst & Young SA
Place de Pont - Rouge 1
Case postale 1575
1211 Genève 26

Dominique Perron
Partner, Business Consulting
Ernst & Young SA
Place de Pont – Rouge, Case postale 1575, 1211 Geneve 26

Place: Geneve

Date: 18th August-2022

1.2. Bidder Information Form

BIDDER'S INFORMATION FORM

1. SUBJECT	
Request for Proposal:	RFP-S-BDT-2022-025
Requirements:	Development, implementation, and maintenance of a "Information Mediator

2. PROPOSAL SUBMITTED BY A SINGLE ECONOMIC OPERATOR	
Bidder:	Ernst & Young SA Place de Pont – Rouge, Case postale 1575 1211 Geneve 26

3. BIDDER INFORMATION[1]	
Corporate Name:	ERNST & YOUNG AG
Legal Status:	Public limited company
Authorized Capital:	CHF 8 000 000.00
Headquarters Address:	Aeschengraben 27 4051 Basel
Place of Business Address:	Place Pont-Rouge 1 1212 Lancy
Telephone:	+41 (0)58 286 85 85
Fax:	+41 (0)58 286 86 00
Trade Registered N°:	CHE - 105.932.265
VAT No:	CHE-105.932.265
UNGM Registration N°:	219328
Date established:	28 September 1998
Permanent Workforce:	3000.000 employees worldwide, 3000 in Switzerland
Number of Secondary Offices:	10
Names of Main Managerial Staff:	Moritz Oberli, Managing Partner Consulting Stefan Rösch-Rütsche, Country Managing Partner Bruno Patusi, Financial Services Country Leader Andre Schaub, Managing Partner Assurance
Names and Job Positions of Person Authorized to represent	Dominique Perron, International Development Leader Axel Timm, Partner
Certification (if any):	CMMI and ISO certificate
Accreditation (if any):	-

Turnover, Net Income for the past Three Financial Years:				
[Currency]	Year 1 [i.e., 2019]	Year 2 [i.e., 2020]	Year 3 [i.e., 2021]	Average
Turnover	685.610 Mio CHF	679.8 Mio CHF	667.7 Mio CHF	677.7 Mio CHF
Net Income (+/-)	552,5 Mio CHF	539,5 Mio CHF	539,5 Mio CHF	543.8 Mio CHF
Comments	-	-	-	-

4. SUMMARY OF WORK DISTRIBUTION			
	Name	Scope of Work/Tasks/Sub-Tasks	Percentage (%) (Non-financial)
	Ernst & Young SA with support from Ernst & Young LLP, India	Complete Scope as per RFP	100%

In the capacity of
Duly authorized to sign proposals for and on behalf of:

Dominique Perron
Partner, Business Consulting
Ernst & Young SA
Place de Pont - Rouge
Case postale 1575
1211 Geneve 26

Place: Geneve
Date: 18-August-2022

1.3. Bidder Declaration Form

Ernst & Young SA
Place de Pont - Rouge
Case Postale 1575

Tel: +41 (0)58 286 85 85
Fax: +41 (0)58 286 86 00
ey.com

BID DECLARATION FORM

Date:18th August 2022 Tender NO. ITU/RFP-S-BDT-2022-025

The ITU requires that all Bidders observe the highest standard of ethics during the solicitation process and the execution of the work. Prospective Bidders shall be aware that ITU enforce a zero-tolerance policy concerning proscribed practices, including corruption, fraud, coercion, collusion, unethical behaviour, and obstruction.

ITU adheres to the UN Supplier Code of Conduct which may be consulted at: http://www.un.org/Depts/ptd/about-us/un-supplier-code-conduct
Prospective Bidders hereby understand and accept that any submission sent to ITU constitutes agreement to abide by, observe and fully cooperate with the application of the mentioned Code of Conduct. Accordingly, any company that is found to have undertaken unethical, unprofessional, or fraudulent activities will be suspended or forbidden from continuing business relations with ITU.
With respect to its proposal submitted in response to ITU's Request for Proposal mentioned above, the Bidder hereby certifies that:

1. The prices in its proposal have been established independently without consultation, communication or agreement with any other competitor or potential competitor with a view to restricting competition.
2. No attempt has been made or will be made by the Bidder to influence any other bidder, organization, partnership, or corporation to either submit or not submit a proposal.
3. The Bidder will not offer, solicit or accept, directly or indirectly, any gratuity, gift, favor, entertainment, promises of future employment or other benefits to or from ITU staff members.
4. The Bidder (parent company and/or subsidiaries) is not identified on, or associated with any individual, groups, undertaking and entities identified on, the list established pursuant to UN Security Council Resolution 1267 (Consolidated List which can be found at the website: https://www.un.org/securitycouncil/content/un-sc-consolidated-list);
5. The Bidder (parent company and/or subsidiaries) will not use the funds received under any contract with the ITU to provide support to individuals, groups, undertakings, or entities associated with terrorism.
6. The Bidder (parent company and/or subsidiaries) is not the subject of any form of sanction imposed by an organization or body within the United Nations System, including the World Bank.

Definitions of terms used in this declaration:
"Coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, another or the property of another to influence improperly the actions of another.
"Collusive practice" is any conduct or arrangement between two or more bidders, designed to achieve an improper purpose, including to influence improperly the actions of another or to set prices at an artificial level or in a non-competitive manner.
"Conflict of interest" is a situation that gives rise to an actual, potential, or perceived conflict between the interests of one party and another.

"Corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of any advantage, in order to influence improperly the actions of another.
"Fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, another to obtain a financial or other benefit or to avoid an obligation.
The undersigned certifies to be duly authorized to sign this Declaration on behalf of the Bidder.

In the capacity of
Duly authorized to sign proposals for and on behalf of:

Dominique Perron
Partner, Business Consulting
Ernst & Young SA
Place de Pont - Rouge
Case postale 1575
1211 Geneve 26

Place: Geneve
Date: 18th August-2022

1.4. EY Certification on Confirmation of Payment of Taxes

AHV AVS AI IV
Ausgleichskasse für das schweizerische Bankgewerbe
Caisse de compensation des banques suisses
Cassa di compensazione delle banche svizzere

Ernst & Young SA
Maagplatz 1
Postfach
8010 Zürich

Zurich, le 15 juin 2022

ATTESTATION
MR100579 Ernst & Young AG

Nous attestons que votre société est affiliée à notre Caisse de compensation et qu'elle verse régulièrement ses cotisations aux assurances sociales suisses suivantes:

- Assurance-vieillesse et survivants (AVS)
- Assurance-invalidité (AI)
- Assurance-chômage (AC)
- Assurance-allocation pour pertes de gain (APG)
- Assurance-maternité Ct. GE
- Caisse d'allocations familiales (CAF)
- Fondo Ticino

CAISSE DE COMPENSATION
DES BANQUES SUISSES

Maria Golia
Remplaçante du chef du service des cotisations

2. Executive Summary

We at Ernst & Young firmly believe that initiatives like the GovStack are needed to foster and help governments to accelerate in their journey toward digital transformation. This coupled with the utilitarian approach of providing such software as a Digital Public Good is what we believe will make the "adoption of technology solutions and evolution of digital systems" sustainable. Ernst & Young AG has partnered with Ernst & Young LLP (India) to leverage its extensive experience & skills in building similar large-scale applications architecting, designing & implementation.

This proposal document addresses the following two broad level activities:

- Design, Development, and Implementation of a "Information Mediator Building Block" and integrate it within the overall GovStack sandbox environment
- Provide Support and Maintenance to maintain the IM-BB according to specifications

A separate hosting environment is not being proposed. Instead, the Sandbox infrastructure provided by GovStack will be used. This will enable a smoother integration with other building blocks and thereby facilitating a faster time to market.

Our Solution Highlights

The proposed solution technology stack comprises of Open-Source based components that have been successfully used in mission critical enterprise level applications. We understand that the event management layer is central to the IM-BB's purpose and has to be designed for scalability and high throughput. We are proposing multiple patterns that build on top of the Akka framework along with a Kafka pub-sub broker to address the complexities of building an efficient mediator. Akka is based on the Actor Model, a proven approach to build event driven, resilient, highly concurrent and distributed systems. The entire solution will be deployed and packaged as per the industry leading practices of containerization while following a microservices based architecture.

Relevant experience

We would like to highlight our involvement in two relevant engagements from which we can leverage key learnings and expertise:

- Ayushman Bharat Digital Mission: India's national level health information exchange ecosystem.
- Social Protection System for the Royal Government of Cambodia: leveraging an X-ROAD (https://x-road.global/) based system for high volume data exchange across various scheme systems
- Unified Mobile Application for New-age Governance (UMANG): Common Integrated Mobile Platform for bringing all Government services under one platform through 500+ integrations and transformation for data exchange using various integration protocols using API gateway and orchestration tools.
- e-Pragati Platform: Unified integration platform delivering 150+ services using cutting edge technologies for data exchange through API integrations and Enterprise Service Bus.

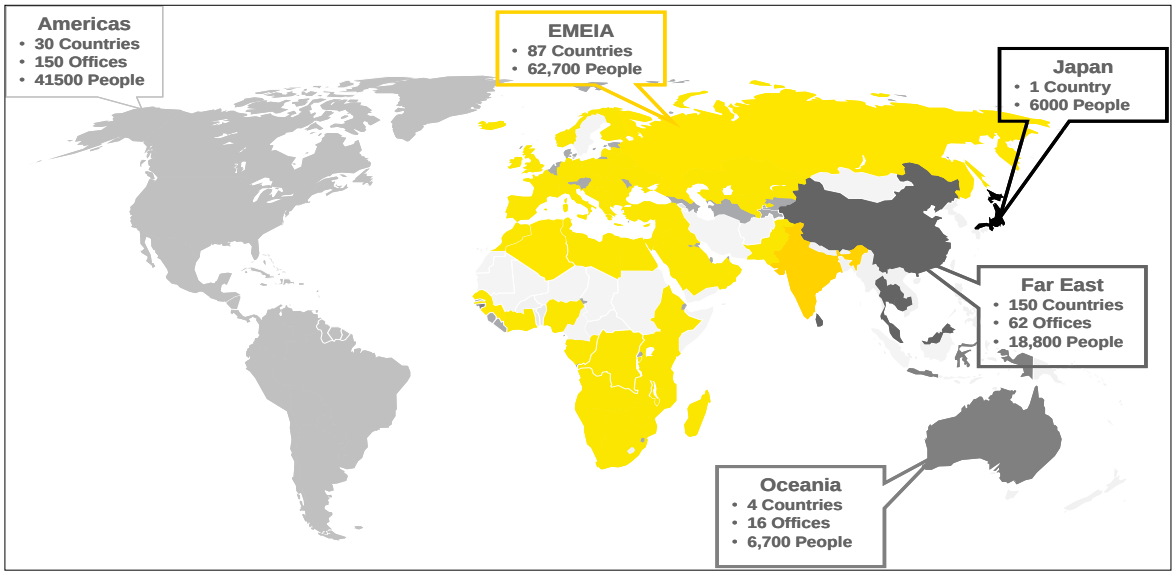
Overall Timelines

We believe that with the technology solution approach and with our relevant experience & expertise, we have a strong value proposition to deliver IM-BB successfully. For the development activity, we are proposing a six-month implementation period followed by a three-month rollout phase that includes deployment and UAT. For the Support and Maintenance phase we are proposing a twelve-month period with a core dedicated support staff that can be augmented with an additional team for each client onboarding.

3. Our Organization - About EY & Experience

Ernst & Young is a global leader in advisory, tax, and transaction and assurance services across 150 countries. Worldwide, our people are united by our shared values and an unwavering commitment to quality. Our **worldwide organization** enables our clients to take full advantage of the resources that are available and helps us to serve our clients with a level of quality and consistency that is superior to that of our competitors. Our people provide consistent quality in all locations and, thereby, contribute significantly to our effectiveness and efficiency. We bring the following key strengths:

- "Quality in everything we do" approach
- One-stop shop solutions
- Local yet international, and
- Spirit of partnership



Ernst & Young takes pride in the fact that it serves clients in every industry across the sector, throughout the world. EY assist Governments, Government Organisations and Public-Sector Companies across all industries to deal with a broad range of policy and business issues. EY has also been working closely with Governments and funding agencies around the world in economic and institutional transition across a range of sectors.

<u>Our Global Government, Public Sector & Not-For-Profit (GPS Practice)</u>

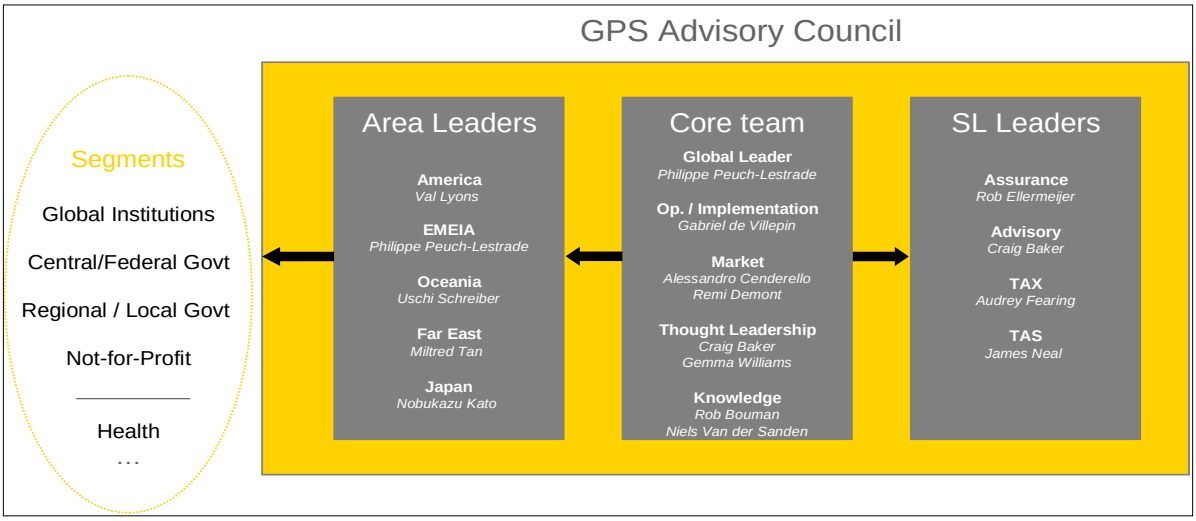
Among international firms, **EY has one of the largest public-sector practices** with nearly a century of service devoted to the public sector and an internal structure to support and enhance our services to Governments. Ernst & Young has significant experience in **advising Governments across the world in areas ranging from technology to process improvement and privatization advice. Globally, Ernst & Young provides services to over 1,000 Governmental units world-wide, including state and local Governments, their departments, municipalities, authorities, public-sector enterprises and not-for-profits.**

We have developed strong and a valuable relationship with Public Policies decision makers at the global level via:

- Dedicate people in each service line and geographies. Move resources to where they are needed
- People to be committed to development of a robust and sensible government sector portfolio
- Invest in people with experience in GPS

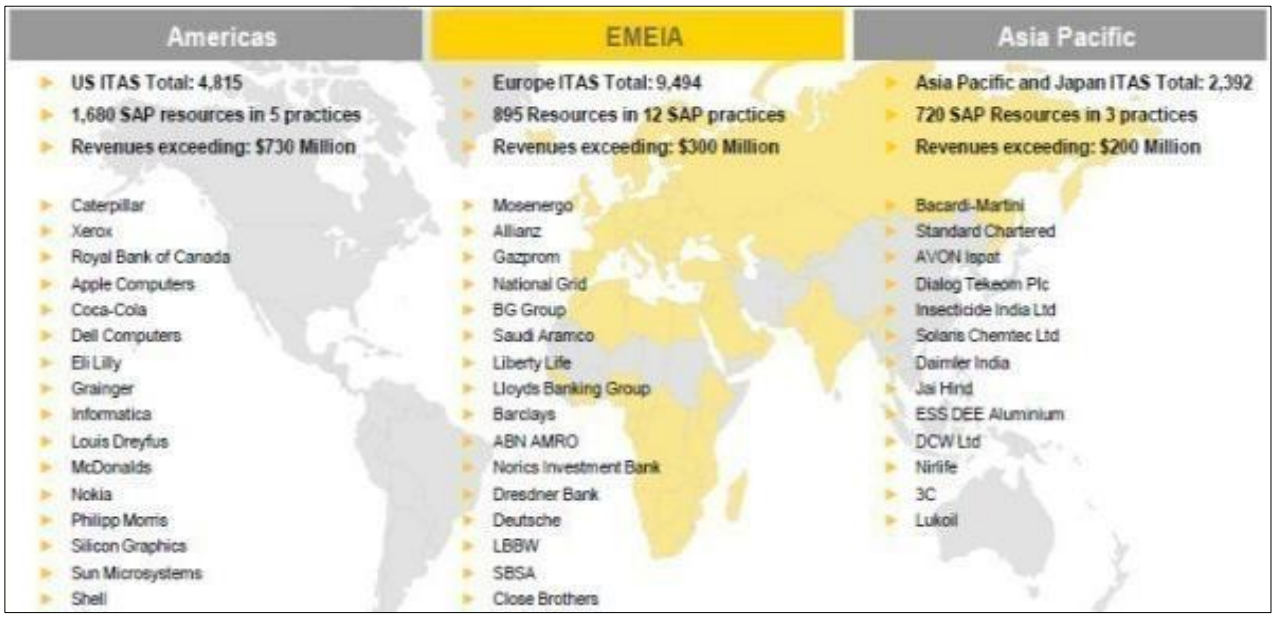
- Provide EY professionals with Client Deck, White Papers and Thought Leadership

We have created **Global GPS Centre of Excellence** organisation which focuses on various aspects of services to Government and Public-Sector Units:



Globally, Ernst & Young has a long history of assisting Government and Public-sector clients on the most complex citizen centric issues. Some of the clients that we have assisted globally are Government of UK and its various department and ministries including UK Home Office, Her Majesty's Revenue & Customs, Royal Mail Group Plc, Central Government Department (HM Treasury), Government Department for Careers Enterprise (Careers Scotland), East of England Development Agency (EEDA), Technology Strategy Board UK, Department of Health, Ministry of Finance - Government of Indonesia, State Revenue Service – Latvia, Ministry of Transport (NSW, Australia), South African Revenue Services, Government of the African countries including Government of Ghana, Zimbabwe, Tanzania, Uganda, Deutsche Post World Net, Ministry of Information & Communication Technology of Jordan etc.

Ernst & Young 's IT Advisory Services ('ITAS') Portfolio gets right to the heart of the matter, implementing business imperatives while optimizing investment and facilitating long-term, measurable business benefits. We can assist you to match your IT initiatives with your business goals, helping you eliminate unnecessary activities and maximize returns. Whether you need to define new services, justify expenditures on a specific project, refine your existing business model, or need project/program management assurance/support our ITAS Portfolio provides the services you need to optimize your IT investments.



Ernst & Young is well equipped to deliver on the requirements put forth in this RFP since we have multiple experience of having successfully delivered such engagements in the past. We fully appreciate and understand that one of the key ingredients of success is having a partnership approach and ability to be actively engaged till completion of the engagement duration and if needed beyond that as well.
Our approach is based on the global Ernst & Young, robust, flexible, technology enabled transformation methodology which has been successfully used on a number of similar projects conducted, inter alia, for mining & metals companies worldwide and tailored to meet the specific needs of the Company.

EY's IT Advisory practice is supported by the Global Talent Hub (GTH), EY's dedicated global service delivery GTH Advisory is a CMM L5 certified entity with access to 2000+ professionals and expertise across sectors. GTH has been purpose-built to support domestic engagement teams and acts as a performance engine, embedding its support into our core service line delivery processes and Account Management activity.

GTH is focused on delivering service line, Knowledge and account management support to our clients around the world. It is founded on "extended teaming" that enables account teams worldwide to provide seamless, high quality, value-added support that helps deliver exceptional client service.

Our professionals across the globe face a variety of challenges which they seek to overcome for our clients. Pooling resources under a global cost model by leveraging skills, scale, wage arbitrage and time zones provides EY with the strategic agility to:

- **Increase access** to large, diverse, highly talented and skilled resource pools
- **Enhance the overall quality** of our engagements with more consistent processes and methodologies
- **Improve engagement margins** through a lower cost of delivery
- **Stay connected and responsive** to client needs around the clock by leveraging the time zone advantage
- **Access avenues of innovation** and new business concepts in service delivery

Our differentiation from our competitors:

- Ernst & Young's IT Advisory Services can provide the right services at the right time to help you get the greatest benefit from your information technology investments.

- Focus on Benefits – We recognize that you are seeking tangible benefits from your investment in information technology, and we have designed our services to assess, inform, and provide meaningful insight and actionable recommendations to help position you to realize additional benefits.
- Flexible Approach – We will work closely with you to align our work with your priorities, understanding and helping to meet your objectives. We tailor the focus and scope of our formal methodologies and frameworks to concentrate on your key business issues and requirements.
- Global – Our global team provides you a consistent level of robust service – anywhere in the world.
- Experienced Team – Our global service delivery team includes individuals with not only IT strategy, planning, assessment, and risk management skills, but who also understand your industry and business operations.

3.1. About EY Switzerland

Intergovernmental organizations such as the World Trade Organization are supported by our dedicated International Development team located in Geneva, Switzerland. This team has a hub of experts in Switzerland dedicated to supporting International Development clients. The global hub aims to deliver sustainable value and impact to international organizations as their most trusted advisor.

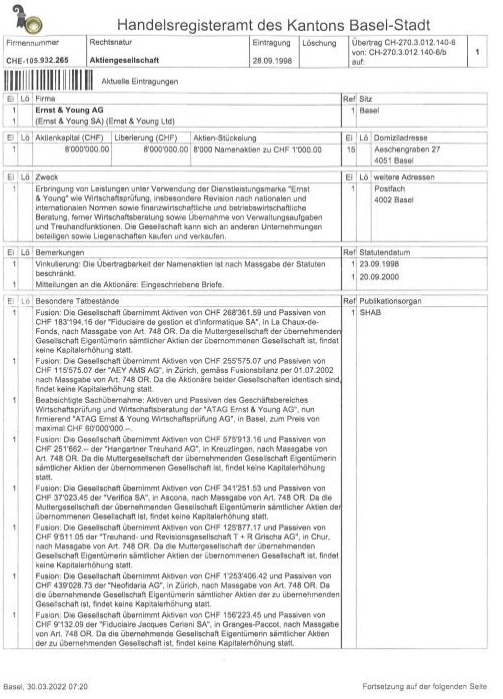
The hub fosters International Development experts, experienced in working with and for Intergovernmental agencies, international NGOs and foundations. The team is led by the Global Client Service Partner for International Development, Dominique Perron, who has more than 20 years of experience working in a variety of countries, focusing on International Development.
The team provides expertise to the industry through delivery of projects and services as well as providing thought leadership and networking events to the International Development community.
Within the EY network, they also provide centralized support, expertise and quality assurance for International Development engagements at EY.

To drive efficiency and transparency in development projects, we have also created the International Development Partners network, which brings together the unique experience of our diverse and globally connected teams to respond to increasing challenges.

For us, it is about being a part of the International Development community, as well as building bridges between public and private organizations and facilitating interactions across communities.

3.2. EY Switzerland Certificate of Incorporation

Ernst & Young AG operates as a public limited company, incorporated in Switzerland in 1998. Further information can be found in the 2022 certificate of incorporation below.



Handelsregisteramt des Kantons Basel-Stadt

Firmennummer	Rechtsnatur	Eintragung	Löschung	Übertrag CH-270.3.012.140-6 von: CH-270.3.012.140-6/b auf:	
CHE-105.932.265	Aktiengesellschaft	28.09.1998			1

Aktuelle Eintragungen

Ei	Lö	Firma	Ref	Sitz
1		Ernst & Young AG	1	Basel
1		(Ernst & Young SA) (Ernst & Young Ltd)		

Ei	Lö	Aktienkapital (CHF)	Liberierung (CHF)	Aktien-Stückelung	Ei	Lö	Domiziladresse
1		8'000'000.00	8'000'000.00	8'000 Namenaktien zu CHF 1'000.00	15		Aeschengraben 27 4051 Basel

Ei	Lö	Zweck	Ei	Lö	weitere Adressen
1		Erbringung von Leistungen unter Verwendung der Dienstleistungsmarke "Ernst & Young" wie Wirtschaftsprüfung, insbesondere Revision nach nationalen und internationalen Normen sowie finanzwirtschaftliche und betriebswirtschaftliche Beratung, ferner Wirtschaftsberatung sowie Übernahme von Verwaltungsaufgaben und Treuhandfunktionen. Die Gesellschaft kann sich an anderen Unternehmungen beteiligen sowie Liegenschaften kaufen und verkaufen.	1		Postfach 4002 Basel

Ei	Lö	Bemerkungen	Ref	Statutendatum
1		Vinkulierung: Die Übertragbarkeit der Namenaktien ist nach Massgabe der Statuten beschränkt.	1	23.09.1998
1		Mitteilungen an die Aktionäre: Eingeschriebene Briefe.	1	20.09.2000

Ei	Lö	Besondere Tatbestände	Ref	Publikationsorgan
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 268'361.59 und Passiven von CHF 183'194.16 der "Fiduciaire de gestion et d'informatique SA", in La Chaux-de-Fonds, nach Massgabe von Art. 748 OR. Da die Muttergesellschaft der übernehmenden Gesellschaft Eigentümerin sämtlicher Aktien der übernommenen Gesellschaft ist, findet keine Kapitalerhöhung statt.	1	SHAB
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 255'575.07 und Passiven von CHF 115'575.07 der "AEY AMS AG", in Zürich, gemäss Fusionsbilanz per 01.07.2002 nach Massgabe von Art. 748 OR. Da die Aktionäre beider Gesellschaften identisch sind, findet keine Kapitalerhöhung statt.		
1		Beabsichtigte Sachübernahme: Aktiven und Passiven des Geschäftsbereiches Wirtschaftsprüfung und Wirtschaftsberatung der "ATAG Ernst & Young AG", nun firmierend "ATAG Ernst & Young Wirtschaftsprüfung AG", in Basel, zum Preis von maximal CHF 60'000'000.--.		
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 575'913.16 und Passiven von CHF 251'602.-- der "Hangartner Treuhand AG", in Kreuzlingen, nach Massgabe von Art. 748 OR. Da die Muttergesellschaft der übernehmenden Gesellschaft Eigentümerin sämtlicher Aktien der übernommenen Gesellschaft ist, findet keine Kapitalerhöhung statt.		
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 341'251.53 und Passiven von CHF 37'023.45 der "Veritica SA", in Ascona, nach Massgabe von Art. 748 OR. Da die Muttergesellschaft der übernehmenden Gesellschaft Eigentümerin sämtlicher Aktien der übernommenen Gesellschaft ist, findet keine Kapitalerhöhung statt.		
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 125'877.17 und Passiven von CHF 9'511.05 der "Treuhand- und Revisionsgesellschaft T + R Grischa AG", in Chur, nach Massgabe von Art. 748 OR. Da die Muttergesellschaft der übernehmenden Gesellschaft Eigentümerin sämtlicher Aktien der übernommenen Gesellschaft ist, findet keine Kapitalerhöhung statt.		
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 1'253'406.42 und Passiven von CHF 439'028.73 der "Neofidaria AG", in Zürich, nach Massgabe von Art. 748 OR. Da die übernehmende Gesellschaft Eigentümerin sämtlicher Aktien der zu übernehmenden Gesellschaft ist, findet keine Kapitalerhöhung statt.		
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 156'223.45 und Passiven von CHF 9'132.09 der "Fiduciaire Jacques Ceriani SA", in Granges-Paccot, nach Massgabe von Art. 748 OR. Da die übernehmende Gesellschaft Eigentümerin sämtlicher Aktien der zu übernehmenden Gesellschaft ist, findet keine Kapitalerhöhung statt.		

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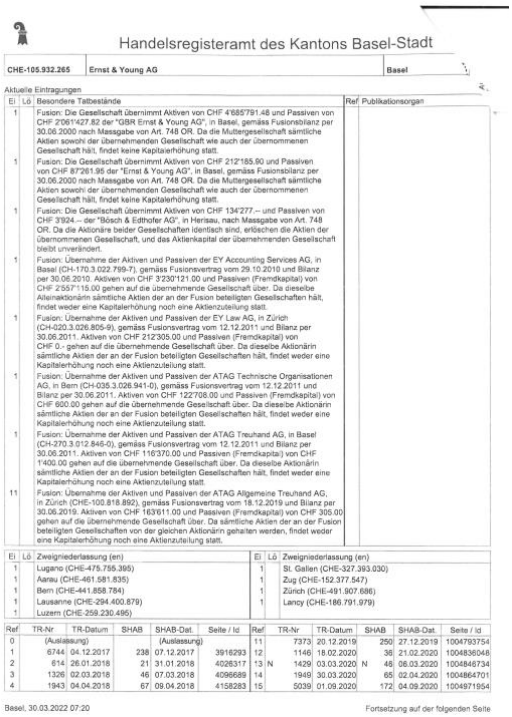

Handelsregisteramt des Kantons Basel-Stadt

CHE-105.932.265	Ernst & Young AG	Basel	2

Aktuelle Eintragungen

Ei	Lö	Besondere Tatbestände	Ref	Publikationsorgan
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 4'685'791.48 und Passiven von CHF 2'061'427.82 der "GBR Ernst & Young AG", in Basel, gemäss Fusionsbilanz per 30.06.2000 nach Massgabe von Art. 748 OR. Da die Muttergesellschaft sämtliche Aktien sowohl der übernehmenden Gesellschaft wie auch der übernommenen Gesellschaft hält, findet keine Kapitalerhöhung statt.		
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 212'185.90 und Passiven von CHF 87'261.95 der "Ernst & Young AG", in Basel, gemäss Fusionsbilanz per 30.06.2000 nach Massgabe von Art. 748 OR. Da die Muttergesellschaft sämtliche Aktien sowohl der übernehmenden Gesellschaft wie auch der übernommenen Gesellschaft hält, findet keine Kapitalerhöhung statt.		
1		Fusion: Die Gesellschaft übernimmt Aktiven von CHF 134'277.-- und Passiven von CHF 3'924.-- der "Bösch & Edthofer AG", in Herisau, nach Massgabe von Art. 748 OR. Da die Aktionäre beider Gesellschaften identisch sind, erlöschen die Aktien der übernommenen Gesellschaft, und das Aktienkapital der übernehmenden Gesellschaft bleibt unverändert.		
1		Fusion: Übernahme der Aktiven und Passiven der EY Accounting Services AG, in Basel (CH-170.3.022.799-7), gemäss Fusionsvertrag vom 29.10.2010 und Bilanz per 30.06.2010. Aktiven von CHF 3'230'121.00 und Passiven (Fremdkapital) von CHF 2'557'115.00 gehen auf die übernehmende Gesellschaft über. Da dieselbe Alleinaktionärin sämtliche Aktien der an der Fusion beteiligten Gesellschaften hält, findet weder eine Kapitalerhöhung noch eine Aktienzuteilung statt.		
1		Fusion: Übernahme der Aktiven und Passiven der EY Law AG, in Zürich (CH-020.3.026.805-9), gemäss Fusionsvertrag vom 12.12.2011 und Bilanz per 30.06.2011. Aktiven von CHF 212'305.00 und Passiven (Freimdkapital) von CHF 0.-- gehen auf die übernehmende Gesellschaft über. Da dieselbe Aktionärin sämtliche Aktien der an der Fusion beteiligten Gesellschaften hält, findet weder eine Kapitalerhöhung noch eine Aktienzuteilung statt.		
1		Fusion: Übernahme der Aktiven und Passiven der ATAG Technische Organisationen AG, in Bern (CH-035.3.026.941-0), gemäss Fusionsvertrag vom 12.12.2011 und Bilanz per 30.06.2011. Aktiven von CHF 122'708.00 und Passiven (Fremdkapital) von CHF 600.00 gehen auf die übernehmende Gesellschaft über. Da dieselbe Aktionärin sämtliche Aktien der an der Fusion beteiligten Gesellschaften hält, findet weder eine Kapitalerhöhung noch eine Aktienzuteilung statt.		
1		Fusion: Übernahme der Aktiven und Passiven der ATAG Treuhand AG, in Basel (CH-270.3.012.846-0), gemäss Fusionsvertrag vom 12.12.2011 und Bilanz per 30.06.2011. Aktiven von CHF 116'370.00 und Passiven (Fremdkapital) von CHF 1'400.00 gehen auf die übernehmende Gesellschaft über. Da dieselbe Aktionärin sämtliche Aktien der an der Fusion beteiligten Gesellschaften hält, findet weder eine Kapitalerhöhung noch eine Aktienzuteilung statt.		
11		Fusion: Übernahme der Aktiven und Passiven der ATAG Allgemeine Treuhand AG, in Zürich (CHE-100.818.892), gemäss Fusionsvertrag vom 18.12.2019 und Bilanz per 30.06.2019. Aktiven von CHF 163'911.00 und Passiven (Fremdkapital) von CHF 305.00 gehen auf die übernehmende Gesellschaft über. Da sämtliche Aktien der an der Fusion beteiligten Gesellschaften von der gleichen Aktionärin gehalten werden, findet weder eine Kapitalerhöhung noch eine Aktienzuteilung statt.		

Ei	Lö	Zweigniederlassung (en)	Ei	Lö	Zweigniederlassung (en)
1		Lugano (CHE-475.755.395)	1		St. Gallen (CHE-327.393.030)
1		Aarau (CHE-461.581.835)	1		Zug (CHE-152.377.547)
1		Bern (CHE-441.858.784)	1		Zürich (CHE-491.907.686)
1		Lausanne (CHE-294.400.879)	1		Lancy (CHE-186.791.979)
1		Luzern (CHE-259.230.496)			

Ref	TR-Nr	TR-Datum	SHAB	SHAB-Dat.	Seite / Id	Ref	TR-Nr	TR-Datum	SHAB	SHAB-Dat.	Seite / Id
0		(Auslassung)		(Auslassung)		11	7373	20.12.2019	250	27.12.2019	1004793754
1	6744	04.12.2017	238	07.12.2017	3916293	12	1146	16.02.2020	36	21.02.2020	1004836048
2	614	26.01.2018	21	31.01.2018	4026317	13	N 1429	03.03.2020	46	06.03.2020	1004848734
3	1326	02.03.2018	46	07.03.2018	4096689	14	1949	30.03.2020	65	02.04.2020	1004864701
4	1943	04.04.2018	67	09.04.2018	4158283	15	5039	01.09.2020	172	04.09.2020	1004971954

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.05.932.265	Ernst & Young AG	Basel	3

.uelle Eintragungen

Ref	TR-Nr	TR-Datum	SHAB	SHAB-Dat.	Seite / Id	Ref	TR-Nr	TR-Datum	SHAB	SHAB-Dat.	Seite / Id
5	2535	03.05.2018	88	08.05.2018	4217605	16	6563	12.11.2020	224	17.11.2020	1005024493
6	2923	28.05.2018	103	31.05.2018	4260999	17	7515	21.12.2020	251	24.12.2020	1005057803
7	3819	09.07.2018	133	12.07.2018	4354251	18	3796	02.06.2021	107	07.06.2021	1005206652
8	5034	05.09.2018	174	10.09.2018	1004452307	19	6749	21.10.2021	208	26.10.2021	1005320162
9	2085	10.04.2019	73	15.04.2019	1004610718	20	366	18.01.2022	15	21.01.2022	1005386637
10	6437	07.11.2019	219	12.11.2019	1004757434	21	1860	28.03.2022	64	31.03.2022	1005439746

Ei	Ae	Lö	Personalangaben	Funktion	Zeichnungsart
1			Gentsch, Daniel, von Schlatt TG, in Attwil	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
1			Schwaller, Patrick, von Luterbach, in Baden	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
1			Widmer, Adrian Bruno, von Ebnat-Kappel, in Zumikon	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
1			Treureva AG (CHE-105.888.546), in Zürich	Revisionsstelle	
1			Amacker, Ariane Irene, von Eischoll, in Wiesendangen		Kollektivunterschrift zu zweien
1			Badertscher Chamoso, Karine, von Morrens VD, in Morrens VD		Kollektivunterschrift zu zweien
1			Balestra, Michele, von Gerra (Gambarogno), in Gerra (Gambarogno)		Kollektivunterschrift zu zweien
1			Beltrami, Pierangelo, von Vezio, in Vezio		Kollektivunterschrift zu zweien
1			Bertoli, Erico, von Lugano, in Ponte Tresa		Kollektivunterschrift zu zweien
1			Bieri, André Martin, von Aesch LU und Ruswil, in Hohenrain		Kollektivunterschrift zu zweien
1			Bludzien, Laurent André, französischer Staatsangehöriger, in Veyrier		Kollektivunterschrift zu zweien
1			Blum, Oliver Stefan, von Zürich, in Zollikon		Kollektivunterschrift zu zweien
1			Britsch, Matthias Christian, von St. Gallen und Diessenhofen, in Bremgarten bei Bern		Kollektivunterschrift zu zweien
1			Christen, Edgar, von Wolfenschiessen, in Unterägeri		Kollektivunterschrift zu zweien
1			Fehr, Rico, von Widnau, in Küssnacht am Rigi		Kollektivunterschrift zu zweien
1			Fuchs, Stefan, von Appenzell, in Herrliberg		Kollektivunterschrift zu zweien
1			Grosselli, Beatrice Norma, von Airolo, in Faido		Kollektivunterschrift zu zweien
1			Hausmann, Anja Stefanie, deutsche Staatsangehörige, in Neuheim		Kollektivunterschrift zu zweien
1			Indermühle, Urs Stefan, von Arnsoldingen, in Basel		Kollektivunterschrift zu zweien
1			Krapf, Roger Pius, von Gaiserwald, in Teufen AR		Kollektivunterschrift zu zweien
1			Leston, Juan, spanischer Staatsangehöriger, in Crissier		Kollektivunterschrift zu zweien
1			MacDonald, Lukas Josef, von Littau und Aristau, in Basel		Kollektivunterschrift zu zweien
1			Müller, Aurélien Arnaud, von Neuchâtel, in Divonne-les-Bains (FR)		Kollektivunterschrift zu zweien
1			Müller, Gregor Iso, von Bütschwil-Ganterschwil, in Winterthur		Kollektivunterschrift zu zweien
1			Müller, Sonja Andrea, von Hochdorf, in Wallisellen		Kollektivunterschrift zu zweien
1			Nydegger, Adrian Marc, von Schwarzenburg, in Zürich		Kollektivunterschrift zu zweien
1			Ottiger, Roman, von Luzern, in Luzern		Kollektivunterschrift zu zweien
1			Rüegsegger, Astrid, von Röthenbach im Emmental, in Zürich		Kollektivunterschrift zu zweien
1			Schwarzwälder, Christian, von Winterthur, in Wittenbach		Kollektivunterschrift zu zweien
1			Senn, Silvan, von Altstätten, in Zürich		Kollektivunterschrift zu zweien
1			Steger, André, von Künten, in Bremgarten AG		Kollektivunterschrift zu zweien
1			Streiff, Kaspar, von Luchsingen, in Schöfland		Kollektivunterschrift zu zweien
1			Zimmermann, Iwan, von Villars-Wangs, in Wangs		Kollektivunterschrift zu zweien
	2		Schaub, André, von Giebenach, in Arlesheim	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
6			Marclay, Christophe Gilbert, von Troistorrents, in Aarau		Kollektivunterschrift zu zweien
	10		Rösch-Rütsche, Stefan, von Ersigen, in Basel	Präsident des Verwaltungsrates	Kollektivunterschrift zu zweien
10			Mason, Scott, australischer Staatsangehöriger, in Basel	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien

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Handelsregisteramt des Kantons Basel-Stadt

CHE-105.932.265	Ernst & Young AG	Basel	4

Aktuelle Eintragungen

Ei	Ae	Lö	Personalangaben	Funktion	Zeichnungsart
10			Herrmann Snijders, Barbara, von Langnau im Emmental, in Zollikon		Kollektivunterschrift zu zweien
10			Jäggi, Lara Jessica, von Madiswil, in Eglisau		Kollektivunterschrift zu zweien
10			Schläb, Nicole, von Gams, in Thalwil		Kollektivunterschrift zu zweien
10			von Arx, Hilary Lee, von Solothurn, in Rüschlikon		Kollektivunterschrift zu zweien
	12		Errico, Robin Ann, von Zürich, in Zürich	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
	12		Alvazian, Christian, französischer Staatsangehöriger, in Lausanne		Kollektivunterschrift zu zweien
	12		Buchmann, René, von Basel und Hinwil, in Binningen		Kollektivunterschrift zu zweien
	12		Michel, Christoph, von Dottikon, in Neuenkirch		Kollektivunterschrift zu zweien
	12		Pfaff, Rudolf Helmut, von Horw, in Wettswil am Albis		Kollektivunterschrift zu zweien
	12		Schleuniger, Gabriela Verena, von Klingnau, in Wädenswil		Kollektivunterschrift zu zweien
	12		Trachsel, Christoph, von Frutigen, in Wil (SG)		Kollektivunterschrift zu zweien
	13		Eckert, Ralf Alfred, von Maur, in Maur		Kollektivunterschrift zu zweien
	13		Osei-Bonsu, Mark Gerard, britischer Staatsangehöriger, in Küsnacht (ZH)		Kollektivunterschrift zu zweien
	14		Keiser, Philipp, von Subingen, in Subingen		Kollektivunterschrift zu zweien
	14		Nyffenegger, Markus, von Wyssachen, in Unterentfelden		Kollektivunterschrift zu zweien
	15		Imoberdorf, Armin, von Obergoms, in Zollikon		Kollektivunterschrift zu zweien
	15		Nikles, Pascal, von Jens, in Küsnacht (ZH)		Kollektivunterschrift zu zweien
	16		Chapallaz, Florian, von Montanaire, in Stäfa		Kollektivunterschrift zu zweien
	17		Blumer, Andreas Konrad, von Glarus Süd, in Kilchberg (ZH)		Kollektivunterschrift zu zweien
	17		Dalla Torre, Michael, von Basel, in Wangen (SZ)		Kollektivunterschrift zu zweien
	17		Wälchli, Michel Peter, von Madiswil, in Bubendorf		Kollektivunterschrift zu zweien
	18		Whitfield, Elizabeth, britische Staatsangehörige, in Zug	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
	18		Boillet, Jeanne, französische Staatsangehörige, in Vevey		Kollektivunterschrift zu zweien
	18		Thonhauser, Julia, österreichische Staatsangehörige, in Rüschlikon		Kollektivunterschrift zu zweien
	19		Cadisch, Michael, von Chur, in Neerach		Kollektivunterschrift zu zweien
	20		Messerli, Michael, von Riggisberg, in Bern	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
	20		Oberli, Moritz, von Rüderswil, in Melnisberg	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
	20		Patusi, Bruno, von Lengwil, in Niederrohrdorf	Mitglied des Verwaltungsrates	Kollektivunterschrift zu zweien
	20		Bumbacher, Michèle, von Basel, in Zollikofen		Kollektivunterschrift zu zweien
	20		Dolente, Iolanda, Italienische Staatsangehörige, in Lörrach (DE)		Kollektivunterschrift zu zweien
	20		Hofer, Reto, von Belmont-Broye, in Küssnacht (SZ)		Kollektivunterschrift zu zweien
	20		Mange, Olivier, von Bière, in Zug		Kollektivunterschrift zu zweien
	20		Minashnichenko, Anna, von Lugano, in Lugano		Kollektivunterschrift zu zweien
	20		Müller, Stéphane, von Glarus Nord, in Troinex		Kollektivunterschrift zu zweien
21			Pierres, Jacques, französischer Staatsangehöriger, in Davron (FR)		Kollektivunterschrift zu zweien

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Dieser Auszug aus dem kantonalen Handelsregister hat ohne die nebenstehende Originalbeglaubigung keine Gültigkeit. Er enthält alle gegenwärtig für diese Firma aktuellen Eintragungen. Auf besonderes Verlangen kann auch ein Auszug erstellt werden, der alle Eintragungen, die aktuellen und die seit 04.12.2017 gestrichenen, enthält.

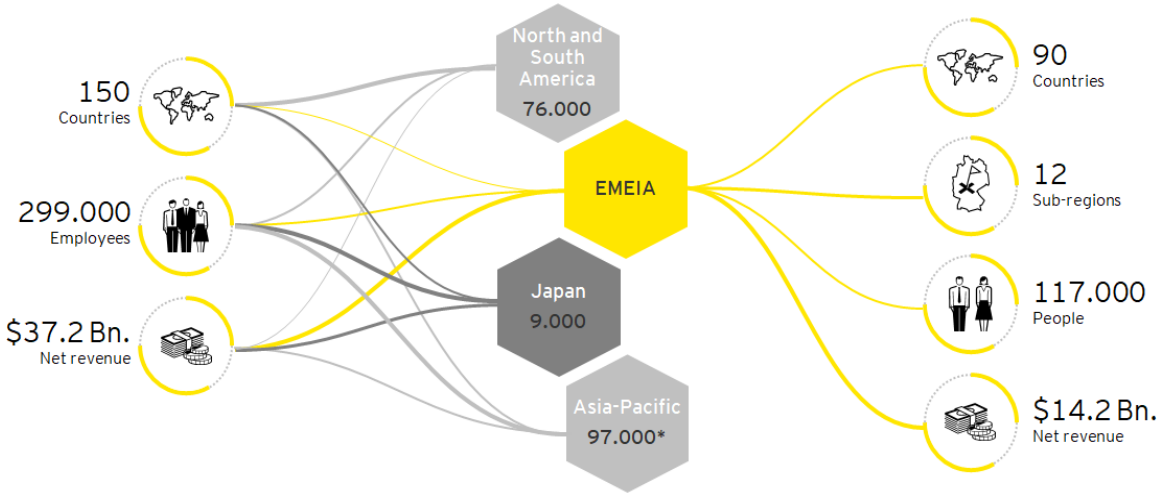
HANDELSREGISTERAMT BASEL-STADT

Handelsregisteramt Basel-Stadt

3.3. EY Presence in Europe & Key Clients

EY is one of the world's leading professional services organizations with a global network of over 720 offices in 150 countries and 299'000 employees. This global capacity enables us to assemble teams which incorporate the appropriate technical, industry and local knowledge for each assignment.
As a global organization, we ensure a geographical coverage all over world. In the case that we do not have a permanent presence in a country, we can staff your project with resources from neighbour countries.

With network of consultants spread across the world, the Technology Transformation practice contains a unique pool of talents ready to bring their diverse skillset to digital transformation projects. EY Switzerland is integrated within the EMEIA support structures that connects Europe, Middle East, India and Africa (EMEIA) but we have of course access to the whole EY network across the world.



EY has a demonstrated record of accomplishment with Intergovernmental organizations, the UN, the EU, governments, and NGOs in 100+ countries across the globe

We pride ourselves in delivering quality services to our clients on all our engagements. Our focused International Development team has a hub of experts in Switzerland dedicated to supporting International Development projects.

Therefore, in addition to the standard quality assurance principles required for each engagement, all work performed for International Development clients in Europe West receive an additional review by

this hub of experts. With their experience working with UN agencies, NGOs, non-profits, and other international and Intergovernmental organizations, they ensure consistent, high standards of delivery. They also make sure that our work is relevant and integrated within the ways of working of these organizations.

3.4. About EY India

EY is a global leader in assurance, tax, transaction and consulting services and the only Big 4 firm integrated across EMEIA (Europe, Middle East, India and Africa) with a strong focus on Government and Public sectors.

Our organization is built on the knowledge base of 300,000 people in 728 offices spread across 150 countries organized into 29 Regions and four areas.

Our country practices are aligned around each of our four strong areas – Americas; EMEIA, which includes Europe, Middle East, India and Africa; and Japan.

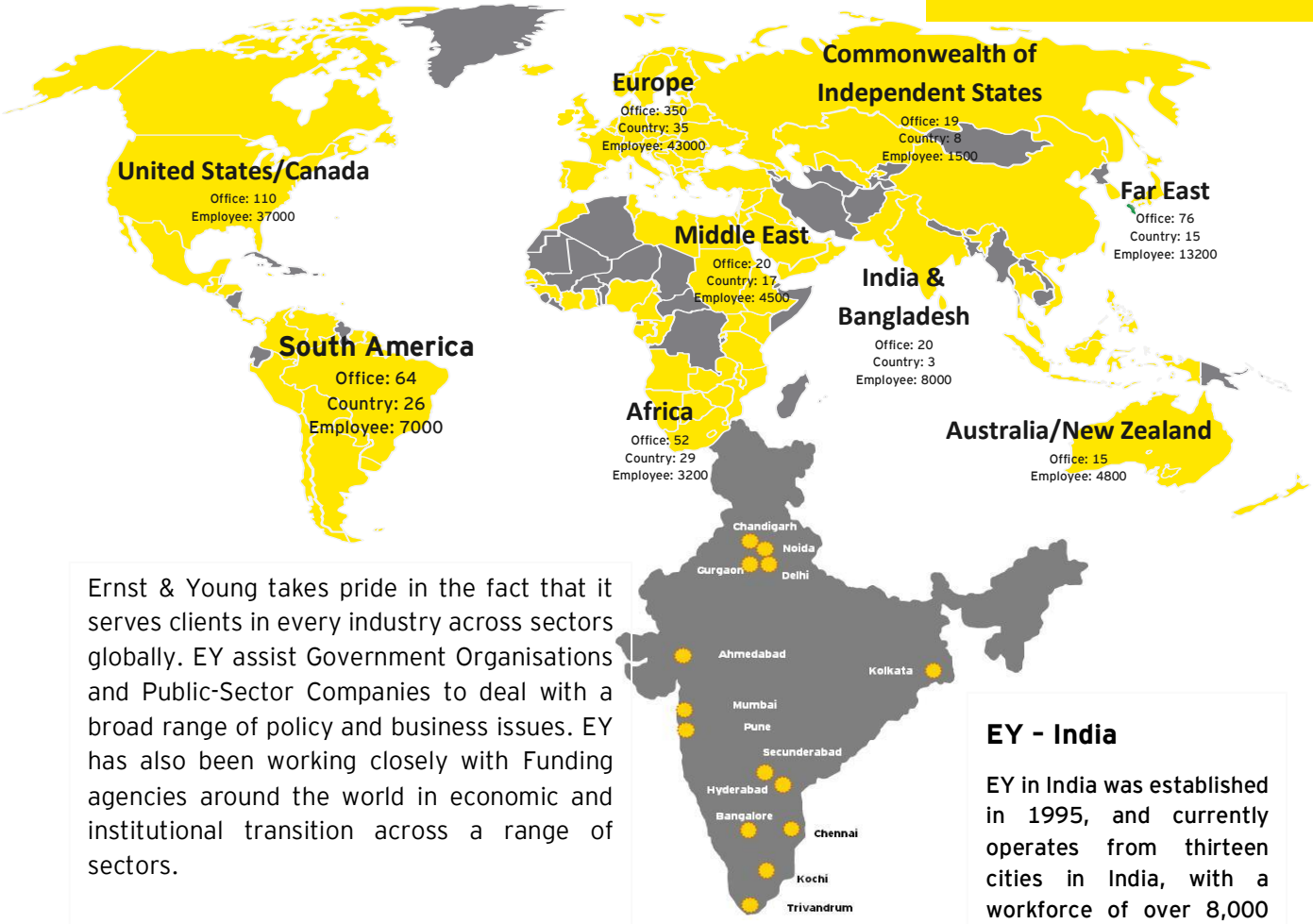
Our professional services are categorised into four core service lines

Transaction Advisory

Tax Advisory

Assurance

Consulting Services
- Business Consulting
- Technology Consulting
- People Advisory Services (PAS)



Ernst & Young takes pride in the fact that it serves clients in every industry across sectors globally. EY assist Government Organisations and Public-Sector Companies to deal with a broad range of policy and business issues. EY has also been working closely with Funding agencies around the world in economic and institutional transition across a range of sectors.

EY – India

EY in India was established in 1995, and currently operates from thirteen cities in India, with a workforce of over 8,000 people and over 200 partners.

<u>Our Global Government, Public Sector & Not-For-Profit (GPS Practice)</u>

Among international firms, **EY has one of the largest public-sector practices** with nearly a century of service devoted to the public sector and an internal structure to support and enhance our services to Governments. Ernst & Young has significant experience in **advising Governments across the world in areas ranging from technology to process improvement and privatization advice. Globally, Ernst &**

Young provides services to over 1,000 Governmental units world-wide, including state and local Governments, their departments, municipalities, authorities, public-sector enterprises and not-for-profits.

We have developed strong and a valuable relationship with Public Policies decision makers at the global level via:

- Dedicate people in each service line and geographies. Move resources to where they are needed
- People to be committed to development of a robust and sensible government sector portfolio
- Invest in people with experience in GPS
- Provide EY professionals with Client Deck, White Papers and Thought Leadership

Ernst & Young is well equipped to deliver on the requirements put forth in this tender since we have multiple experience of having successfully delivered such engagements for other Urban Local Bodies. Further since we have been engaged and are currently engaged in some of the multi-year strategic & large-scale government initiatives with Centre & State Government entities would give further confidence to Housing & Urban Development Department, Government of Odisha on our ability to deliver quality results in appropriate timelines. We fully appreciate and understand that one of the key ingredients of success is having a partnership approach and ability to be actively engaged till completion of the engagement duration and if needed beyond that as well.

Our approach is based on the global Ernst & Young, robust, flexible, technology enabled transformation methodology which has been successfully used on a number of similar projects conducted, inter alia, for mining & metals companies worldwide and tailored to meet the specific needs of the Company.

EY India's service lines have deep and current industry knowledge. This is fine-tuned, pertinent knowledge based on our decades of experience in our truly global network that has been built on – on-the-ground, local knowledge

Our differentiation from our competitors

- Ernst & Young's Technology Consulting Services can provide the right services at the right time to help you get the greatest benefit from your information technology investments.
- Focus on Benefits – We recognize that you are seeking tangible benefits from your investment in information technology, and we have designed our services to assess, inform, and provide

meaningful insight and actionable recommendations to help position you to realize additional benefits.

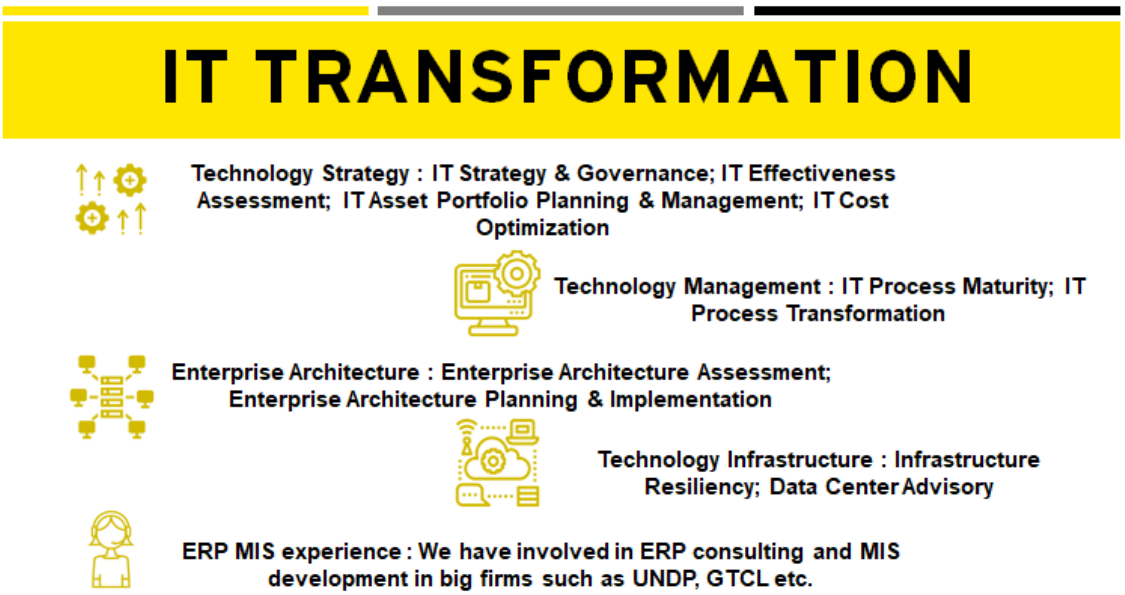
- Flexible Approach – We will work closely with you to align our work with your priorities, understanding and helping to meet your objectives. We tailor the focus and scope of our formal methodologies and frameworks to concentrate on your key business issues and requirements.
- Global – Our global team provides you a consistent level of robust service – anywhere in the world.

Experienced Team – Our global service delivery team includes individuals with not only IT strategy, planning, assessment, and risk management skills, but who also understand your industry and business operations.

Our Service Offerings In ICT

Technology Consulting Services practice is an enabling competency in support of Ernst and Young's Performance Improvement and Risk services. While we understand that economies across the world are focussed around performance improvement and optimization, technology support has increasingly become the foundation of these transformations. This support requires deep technical understanding in the key technologies used by our clients such as SAP, Oracle, a variety of industry specific packages, and general Business Intelligence, risk, and reporting toolsets. Consequently, in alignment with our client's requirements, IT Advisory develops and maintains the deep technical expertise required to support our clients in understanding the technical aspects and required systems changes in support of their performance improvement activities.

Technology Consulting creates the frameworks, methods, and offerings required to understand what constitutes an effectively functioning IT department and how to enable the end objectives. Supporting offerings under this comprehensive framework includes elements such as IT Strategy, IT Architecture, Information Management and Information Architecture, IT Effectiveness, IT Policy and Governance, IT Organization and Leadership, Engineering Process, IT Infrastructure and IT Applications Portfolio Analysis and Rationalization Services, and Sourcing Advisory.



System Implementation & Integration

Business transformation enables global companies to make wholesale change in organizational and process design, improving efficiency and quality. This invariably requires a significant investment in new

IT systems. These new systems are typically either bought as packages and configured to support the new processes (e.g., SAP) or are custom built (i.e., programmed) from scratch. In some cases, packages such as SAP can be customized (re-programmed) to fully address the organization's specific needs.

IT Enablement

Our strategy is to compete in the higher value end of the IT marketplace. We focus on engagements that:

- Enable our core offerings in enterprise level digital transformation through emerging technologies, design, architecture, and implementation across verticals (e-Government, Health, Finance, Customer, Supply Chain/Operations).
- Are part of client initiatives that are business-led, technology-led (digital public good, transformation-oriented, presence of a value proposition, etc.), we offer combination of business consulting & technology implementations to achieve desired outcomes.

We have significant expertise in providing IT advisory and enablement services to various Government and Public Sector Enterprises across geographies and market sectors

Sectors

- Financial Services
- Public Finance Management
- Citizen Services
- Agriculture, Rural Development & Livelihood
- Power & Utilities
- Skill Development & Education
- Health & Identity
- Security & Defense

Strengths

- Dedicated team of more than 2500 in GPS India
- Extensive Knowledge across Ministries and State Government
- Global Network across 150 countries in the world
- Significant experience in system design and development for web and Mobility
- Globally, EY provides services to over 1000 Government units

Services

- Enabling Technology
- Enterprise Intelligence
- IT Risk & Assurance
- IT Transformation

Our Value Proposition

Process and design	Responsible for process design, business analysis, requirements capture (High Level Design) and functional design (Detailed Design).
Solution architecture	Architects a consistent and cohesive solution across all work streams and vendors. Responsible for process, data and application architectures. Manages the resolution of design issues and the change control process.
Security and controls	Responsible for the definition of the risk appetite and controls framework. Defines the manual and system controls for the solution. Develops roles and responsibilities for the solution.
Reporting and information management	Defines the reporting and management information framework, and designs operation and management information reports across all systems.
Design and development	Design and development of core solution. Set-up and customization of the solution. Responsible for the technical design and development of all enhancements, including management information reports
Data management	Responsible for the analysis and design of data migration and archiving solutions. Runs the mock migrations and reconciliation between legacy and target systems.
Test	Definition of a test strategy and approaches for the test project. Includes a number of functional and non-functional test stages to assure the solution under test.
Infrastructure	Responsible for the definition of logical and technical infrastructure designs (e.g., network, hardware and environments). Deliver and configure the development, test and production environments.
People and organizational change	Responsible for assessing the change impacts to the business, defining change strategies, engaging with business users and delivering the training plan. Addresses both creating business engagement and business readiness.
Service introduction	Defines and manages the cutover and deployment plans. Includes the definition and set up of the service management function and transition from the project to the ongoing structures.
Project management	Responsible for the initiation of a project and its management throughout the delivery lifecycle. Defines all project plans and manages to agreed time, cost and quality tolerances across all work streams.

4. Recent References

S.No.	Client Name, Location, and Date of Execution	Description of the project and works/services performed	Contract Currency	Contract details Reference Name, Tel/Email
1.	**National e-Governance Division,** **Unified Mobile Application for New-age Governance (UMANG)** **New Delhi, India** **Date of Execution – 30th Sept 2019 – Till Date**	UMANG ecosystem is meant to provide high volume service delivery, service orchestration and integration through e-Services under highly available and scalable infrastructure sought to be provided by UMANG and will be delivered through multiple Omini channel presence over Mobile App, Portal, KaiOS, Chatbot etc. Narrative description of Project: EY is engaged by the client to maintain and enhance existing UMANG Platform with an aim to integrate with 200 government applications to provide around 1200+ high impact services ▪ Transition of Platform and Applications from existing Partner Agency ▪ Maintain and enhancement of Core platform, Applications and Existing services ▪ Service enablement on Umang Platform ▪ Infrastructure (application hosted at NIC Cloud) management, Operations and Maintenance of the complete UMANG backend and processes of UMANG ▪ Security audit of the UMANG Platform **Technology Stack** – Java 8, AWS, Spring Boot, docker, APISIX, WSO2, PostgreSQL, Kafka, Redis, Jenkins.	Approx. $2.83 Mn USD	Mr. Debabrata Nayak dnayak@digitalindia.gov.in Tel - +91 9599711022
2.	**CBDT (Central board of direct Taxes project Insight** **Uttar Pradesh, India** **Date of Execution – July 2016**	EY is assisting Larsen & Toubro InfoTech (SI) in project Insight for CBDT. EY design, develop, implement, and maintain the Project Insight for a period of five years after Go Live date on turnkey basis. Services ▪ Requirements Gap Analysis	Approx. $2.62 Mn USD	Mr. Rajnish Gupta rajnish.gupta@lntinfotech.com Tel - +91 9717998769

		▪ BI & Analytics Track ▪ Enterprise Architecture Design and Implementation ▪ Project Management ▪ Data Analytics and Predictive modelling **Technology Stack** User Interface and Portal: Spring MVC, HTML, CSS, JS Programming Language: SAS, WSO2, Solr Search, ArcGIS Core engine and workflow: Web Crawler, Reporting & Analytics, Spring MVC, Open Project Database – PostgreSQL, Hadoop, Tera data		
3.	**ICT Platform National Social Protection Council of Government of Cambodia (Funded by ADB Cambodia) From April 2021 – Till Date**	**Description of Project** The RGC introduced a new Social Protection Policy Framework in 2017. ID Poor, a central targeting mechanism for poor households, is the main tool for registering the poor and is managed by the Ministry of Planning (MOP). The RGC is implementing various social protection programs and plans to expand these programs in term of coverage and type of services. However, there are many challenges in the delivery of social benefits, including limited coverage, inaccurate target beneficiaries, and inefficient management of the various social protection programs. To address these challenges, the National Social Protection Council (NSPC), the national agency in charge of the social protection programs, plans to develop an integrated IT-based service delivery system supporting various social protection programs. The Ministry of Economy and Finance (MEF), which chairs the NSPC, is spearheading the social protection reform and requests ADB technical assistance to support development of the social protection registration system. Responding to the request, a	USD 1,169,180	Mr. Chhutlay Veasna +855 965273281 chhutlayveasna@gmail.com

		diagnostic study on ICT for social protection in Cambodia was carried out in 2019 under the ADB-funded Inclusive Finance Sector Development Program **Technical Stack** – Spring Boot, Camunda, PostgreSQL, OpenKM, APISIX, Keycloak. Redash, FormsFlow.ai, Sunbird RC, OSTicket. **Description of actual services provided by your staff within the assignment:** **(i) Phase 1. Business process re-engineering and information strategy planning for an integrated ICT platform for social protection program.** ▪ Business Process Re-engineering ▪ Information Strategy Planning ▪ Define the ICT infrastructure (on-premises or cloud hosted at government data center) requirements ▪ Define the capacity development planning ▪ Design the social beneficiary registry and onboarding of the two schemes on to the ICT platform (particularly elaborate the strategy on how to link the ID Poor database which is partially functioning as a social beneficiary database in Cambodia) ▪ Elaborate more on the system integration strategy with other relevant IT systems in governments including MOP's ID Poor database, GDI's national ID system, PCA's PMRS, NSSF's HSPIS, MOSAVY's CCT management information system, etc. ▪ Implementation Planning ▪ Develop a 5-year master plan and an implementation strategy for the integrated ICT		

		platform for social protection programs with road maps. ▪ Develop key performance indicators and key success factors to achieve target goals ▪ Develop a mid-term (3-5 years) implementation plan including a plan to implement the To- Be standardized e-government model linking to ADB funded Fourth Greater Mekong Subregion Corridor Towns Development Project. **(ii) Phase 2. Development of the integrated ICT platform for social protection programs** **IT development** ▪ Detail design and prototyping of the IT systems of core functions ▪ Develop the IT systems of core functions including scheme registration, beneficiary registration, disbursement management, and social ID generator. ▪ Prepare detailed design and prototyping of the IT systems of non-core functions ▪ Develop the IT systems of non-core functions such as business intelligence (BI), grievance redress system (GRS), mobile payment, text message and email notification, etc. ▪ Provide the customization strategy if the firm would use its own off-the-shelf solution ▪ Provide technical support in identifying / developing / deploying IT solutions to ensure smooth transition to the computerized work process form the manual process. ▪ Provide detailed design and development of the integrated IT systems linking to other relevant IT systems in governments including MOP's ID Poor database, GDI's national ID system, PCA's PMRS, NSSF's HSPIS, MOSAVY's CCT management information system, etc.		

		▪ Arrange for possible linkages of beneficiary IDs to KidC (National ID) as well as ID Poor database. ▪ Development and customization, integration with external systems. ▪ Explore deployment of Cloud IT systems. ▪ Proof of Concept ▪ Test individual IT systems. ▪ Test data exchange and integration ▪ Arrange for testing of user acceptance **(iii) Phase 3. Pilot of integrated ICT platform for social protection programs in selected districts** ▪ Develop detailed implementation plan for the pilot project including the roll-out plan, promotion, out-reaching, training and capacity development in target pilot districts. ▪ Prepare key performance indicators for services of the IT systems ▪ Prepare detailed registration plan or onboarding strategy of target beneficiaries ▪ Enroll target beneficiaries (around 10,000 beneficiaries) by capturing required data set including biometric information from the other relevant IT systems, and entering the information into the pilot system ▪ Link the beneficiary database using the unique ID number to relevant IT systems in other government agencies and make sure the uniqueness of beneficiaries through deduplication process ▪ Provide technical support to onboard the partners ▪ Prepare detailed operational/maintenance plan and manuals ▪ Roll out the pilot system in target pilot districts.		

		▪ Operate the integrated ICT platform for 6 months together with the NSPC team. ▪ Provide training for the NSPC team and hand operations to the NSPC team, including: ▪ Content development (for online and offline modules) ▪ Training strategy development and design the training calendar ▪ Content dissemination through workshops ▪ Periodic training evaluations ▪ Manage ongoing upgrades/enhancements to the platform. ▪ Provide technical supports to the NSPC team. ▪ Elaborate more on the firm's local presence or the working arrangement with its local partner for implementation.		
4.	**e-Pragati Authority** **Andhra Pradesh, India** **Date of Execution – Nov 2017**	EY provided e-Governance services to citizens, departments, and business through digitally infrastructure (Mobile Apps) on a single platform for seamless Integration of all state and central government departments and business, making transactions electronic and cashless. Services ▪ Develop Services and Mobile Apps ▪ Setting and integration of Big Data Platform with applications ▪ Conduct Testing on all ePragati integrated applications or services ▪ Develop interfaces for Integration of all applications relating to e-Pragati Project ▪ creation, documentation and publishing of APIs in app store for departments and external entities/third parties	23 Mn USD	

		▪ EY implements a detailed security policy for the platform using global standards such as ISO 27001 ▪ EY sets up the infrastructure like software installation & deployment of the services **Technical Stack** – MuleESB, Pegasystems, PostgreSQL, Cassandra, Opensource, Jenkins, Zabbix, Hortonworks.		
5.	**Bangladesh Computer Council (BCC)** **Dhaka, Bangladesh** **Date of Execution – Nov 2014**	**Narrative description of Project:** Client Situation: Bangladesh Computer Council (BCC), an autonomous body under the Ministry of Post, Telecommunication and Information Technology (MoPT&IT) is actively functioning for the expansion of Information Technology by implementing different programs in different regions in Bangladesh. Leveraging ICT for Growth, Employment and Governance is a project of Bangladesh Computer Council (BCC) under the Ministry of Posts, Telecommunication and Information Technology. The project aims to provide a strong foundation for public sector modernization through development of policies, guidelines, norms & standards, and capacity development of the government people. The objective of this consultancy assignment ("Establishing Enterprise Architecture and Interoperability Framework") is to assist Government of Bangladesh (GoBD) through BCC to design, develop, deployment and use national enterprise architecture (NEA) and interoperability (eGIF) for better strategies, processes, plans, structures, technologies and systems across the government. **Description of actual services provided by your staff within the assignment:**	2.92 million USD	

		▪ The key elements included in the scope of work for the E&Y with respect to the Consultant for establishing Enterprise Architecture and Interoperability framework for Bangladesh Computer Council, are as follows: ▪ Establishment of the contours and the broad structure for whole-of-government EA framework (NEA). ▪ Identification and elaboration of NEA entry points factoring in GOB's characteristics, structure, challenges and other influencing factors through a detailed assessment. ▪ Typical entry points to include government operational efficiency, IT planning and optimization systems of systems, service architecture and governance risk and compliance. ▪ Selection of the most appropriate areas for detailed development, with a focus on areas linked to Bangladesh's national priorities initially at Upazilla level. ▪ Development of architecture and standards, with emphasis on ICT aspects of EA including Technical Reference Model (TRM). ▪ Preparation of the Mobile Service Delivery Platform (MSDP) architecture and standards. ▪ Design, development and implementation of interoperability framework across the Government of Bangladesh. ▪ Development of architecture and interoperability framework realization roadmap, including scope and nature, Business Reference Model (BRM) and the guidelines for architecture development. ▪ Expansion of the architecture and standards to include the other facets (i.e. data, application, business, interoperability and security). This will		

		include development of Data Reference Model (DRM) and the Application Reference Model (ARM) in a progressive phased manner. As the reference models come on board, compliance mechanisms will be put in place. ▪ Incorporation of the established architecture and standards as mandatory criteria for all future procurements. ▪ **Design, development and implementation of National e-Service Bus: It will be an interoperable application integration middleware (software) solution that can be a platform where other e-services can be integrated. The e-Service Bus will support a Data Exchange Platform and integration for three e-Services. The electronic Service Bus will deliver service status dashboard with basic MIS functionality for three services.** ▪ For the identified set of essential services EY shall be building recommended set of necessary data standards including APIs to be perused for application developments by Government of Bangladesh. Software for data exchange requirements for the identified three services which can be used for BCC scaling and augmentation through APIs will be delivered. ▪ Design, Development and implementation of three select e-Services: Three essential s-Services will be identified, designed, developed and implemented in the infrastructure and facilities provided by the BCC through National Data Center and network. Service design and documentation would be further perused to build the software suite including using Open Source Software. **The following essential features may form a part of**		

		the demonstration of EA framework suite: ▪ gateway and services integration (payment & SMS) ▪ workflow/rules implementation for three services ▪ mobile application ▪ mobile integration ▪ user management & authentication ▪ portal interface ▪ service process documentation ▪ project management tool ▪ module development ▪ integration with Document Management System (DMS) service, if available ▪ MIS report ▪ service logic ▪ document upload features ▪ solution component, installation & deployment		

5. Technical Proposal

This section covers the following components:

- Compliance to the RFP requirements
- Proposed solution overview including functional, solution and technology architectures
- Core Technical and building block components proposed

5.1. Understanding of Current Initiative

Information Mediator Building Block (IM-BB): An initiative of INTERNATIONAL TELECOMMUNICATION UNION (ITU) for the Development, implementation, and maintenance of an "Information Mediator Building Block". ITU intends to create a secure gateway to exchange information across various department applications (known as GovStack), external applications and existing legacy systems. The backend platform is core to enable greater interoperability across systems.

IM BB will provide a federated integration digital service platform for various e-governance services and digital assets. e-Government interoperability is becoming an increasingly crucial issue, especially across government stacks and legacy solutions that have committed to delivering digital services. Enhanced government efficiency and transparency, coupled with the delivery of basic public services to all citizens, are essential components required to achieve such goals. To date, most governments have finalized the design of national e-government strategies and are busy implementing such priority designs & solutions.

ITU IM-BB's envisioned core foundation of creating a unified interoperable platform among various e-government apps and external applications will facilitate the followings -

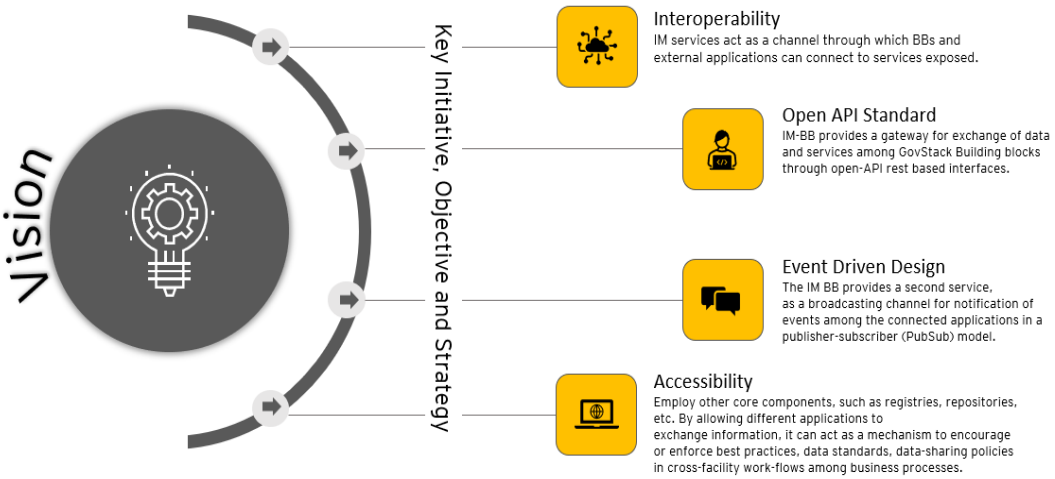
- Different Building Blocks' interoperability leads to better decision-making. Interoperability will allow data compiled by different GovStack building blocks to be used together to make better decisions.
- The interoperability allows for better coordination of government programs and services to provide enhanced services to citizens and businesses.
- If information about government is easier to obtain, policymakers can design better project outcomes and can more easily avoid redundant or similar projects.
- Furthermore, policy- and decision-makers would have more information by which to evaluate the performance of the ecosystem and the public services they deliver.

ITU wants to bring a specialized company for developing the IM-BB, enabling more services by integrating this platform with different building blocks in the secure mode department's platform/applications, operations, and maintenance of the platform. In addition, IM-BB must establish and maintain interoperability with all the external and internal systems including other GovStack building blocks and their technology partner.

Clearly defined vision and objectives for the IM-BB along with the challenges faced in the current scenario can lead to finding the appropriate solution which can be established on a long-term basis.

5.1.1. Vision of Information Mediator Building Block

ITU's Information Mediator Building Block is one of the key initiatives to develop a common, unified platform and to facilitate point-to-point secure access of data across systems and other building blocks to all government services. The application will enable different systems to share data-driven digital services from the Government, the legacy systems, and other applications.
IM-BB is conceptualized to bring a mediation layer to provide a gateway for the exchange of data and services among GovStack Building blocks through open-API specifications to ensure interoperability and policy implementation of standards. IM services act as a channel through which BBs and external applications can connect to services exposed by other BBs such as registry services, identity services, and payment services. The IM-BB provides a second service, as a broadcasting channel for notifying events among the connected applications in a publisher-subscriber model. This component may employ other core components, such as registries, repositories, etc. By allowing different applications to exchange information, it can act as a mechanism to encourage or enforce best practices, data standards around the ecosystem, and data-sharing policies in cross-cutting workflows among business processes.
The below diagram provides an overview on Vision and Objectives of ITU's IM-BB platform -



IM-BB is focused on below major objectives:

- To act as an enabler and facilitator in developing an overall secure gateway for data exchange.
- Provide easy access to apps and BBs to various services through the federated architecture of uniformed Omni-channels.
- Provide easy discoverability of services, easy manageability, and standardization of service delivery.
- Provide a platform for quick enablement of e-Gov applications/services of GovStack through easy and fast integration, on-boarding, and secure roll-out by bringing their services through the platform.
- Provide another value-added service to departments via a common platform through integration with external apps, Payment gateway and other registries. This will facilitate easy onboarding of GovStacks.

5.1.2. Solution compliance mapping matrix for functional requirements

S.No.	Main Functionality	Feature	Reference Section
5.1	**Service Access Layer**		**5.2.5.1**
5.1.1		Administrative Interface	5.2.5.1.1

S.No.	Main Functionality	Feature	Reference Section
5.1.2		Administrative User Roles	5.2.5.1.2
5.1.3		Registration	5.2.5.1.3
5.1.4		Accessing Services	5.2.5.1.4
5.1.5		Directory Service	5.2.5.1.5
5.2	**Pub-Sub Layer**		**5.2.5.2**
5.2.1		Adherence to Key Concepts	5.2.5.2.1
5.2.2		Facilitating Publish/Subscribe	5.2.5.2.2
5.2.3		Defining Message Types	5.2.5.2.3
5.2.4		Broadcasting a Message	5.2.5.2.4
5.2.5		Maintaining and Displaying Message Logs	5.2.5.2.5
5.2.6		Retrying Messages	5.2.5.2.6
5.2.7		Registering/Updating/Deleting a Subscription	5.2.5.2.7
5.2.8		Message Receipt/Delivery Logging and Audit Trail Generation	5.2.5.2.8
5.3	**Log Management**		**5.2.5.3**
5.3.1		The Information Mediator BB maintains a message log.	5.2.5.3.1
5.3.2		The information Mediator BB has full audit trail capabilities.	5.2.5.3.2
5.4	**Monitoring**		**5.2.5.4**
5.4.1		Operational monitoring	5.2.5.4.1
5.4.2		Environmental monitoring	5.2.5.4.1
5.5	**Scaling/ Throughput**		**5.2.5.5**
5.5.1		High Availability	5.2.5.5.1
5.5.2		scalable performance	5.2.5.5.2
5.5.3		Network Load Balancer	5.2.5.5.3

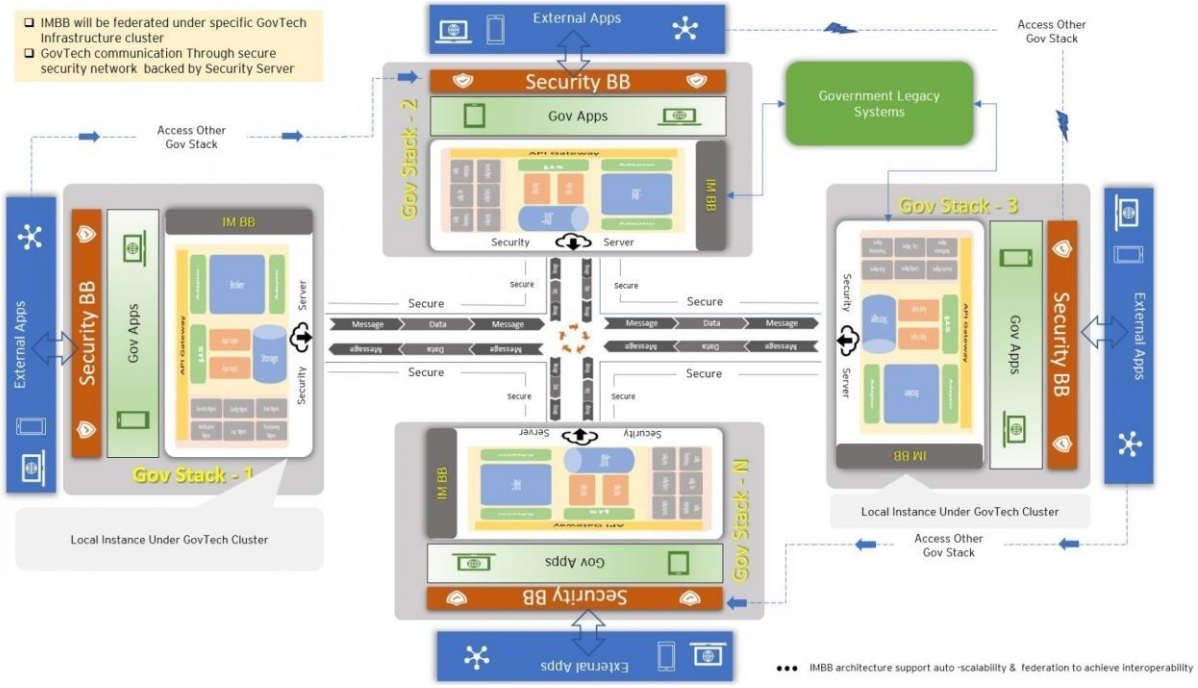
5.1.3. AR Specifications compliance with proposed solution components

S. No	Description	Comment	Proposed Solution Coverage	Technical Stack
1	Participants must fulfil requirements to connect to Mediator: Connected system must follow described security rules	required	Compliant	WireGuard
2	Connected system must be authenticated and authorized by Mediator	required	Compliant	WireGuard
3	Each participant has one (own) entry point to Mediator	recommended	Compliant	WireGuard
4	Mediator works with following protocols: ▪ REST – required ▪ SOAP – recommended ▪ Streaming - recommended		Compliant & Customization	APISIX & Apache Camel
5	Mediator implements following communication patterns: ▪ Synchronous – required ▪ Asynchronous – recommended ▪ Publish/subscribe – recommended		Compliant & Customization	APISIX & Apache Camel, KAFKA

6	In asynchronous and publish/subscribe mode Mediator implements "store and forward"	Required if mode available	Compliant	KAFKA
7	Only sender and receiver see content of message	recommended	Compliant	KAFKA
8	For every message there must be clear who is sender and who is receiver	required	Compliant	KAFKA
9	There must be guarantee for integrity of messages	required	Compliant	KAFKA
10	There must be guarantee of non-repudiation of messages	recommended	Compliant	KAFKA
11	Messages can be used as evidence in court	recommended	Compliant	ELK
12	Mediator implements service discovery features	recommended	Compliant	Elasticsearch
13	Mediator implements service publishing features. For REST services OpenAPI is used. For SOAP - WSDL files.	recommended	Compliant	APISIX
14	Mediator implements message routing	required	Compliant	APISIX
15	Mediator have logging mechanisms	required	Compliant & Customization	APISIX & SL4J
16	Mediator have monitoring functions	recommended	Compliant	Grafana, Prometheus

5.2. Proposed Solution

IM-BB or information mediator building block is an initiative driven by ITU to enable GovStack modules to interact or exchange data amongst other GovStack modules in an interoperable way. The current understanding of a GovStack is that it is a module that wraps an already developed functional module and can exchange data with other GovStack BB and other publicly hosted entities outside the GovStack environment.



Picture 1 – Proposed Solution Architecture

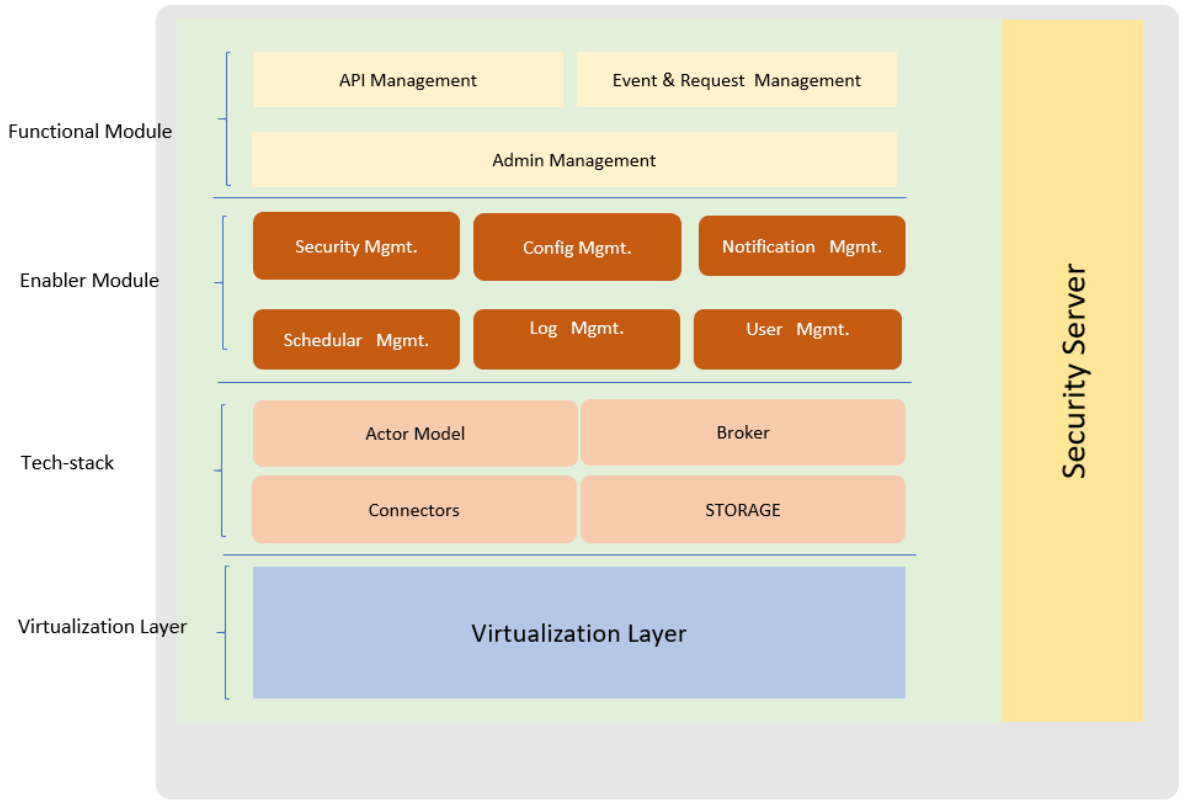
There are three kinds of interactions possible with and within the GovStack module

- External Apps or Systems: This interaction happens via Security Building Block
- Other GovStack BB: This interaction happens via Security Server which is hosted along with mediating module inside IM-BB
- Local Member Instances: This interaction happens via Mediating Module directly or with other legacy applications in which case the interaction is initiated by Mediating Module.

Our proposed solution is to create a ubiquitous mediating module that can front-end local members with configurations and can initiate the exchange of messages with other GovStack modules with just configuration and minimal code intervention.
The proposed design of IM-BB makes it containerized deployable module which has all the wherewithal to manage itself, threshold driven scale-up/scale-down when required and manage data exchange pipelines as and when required. Managing data exchange pipelines and managing the lifecycle of a user, subscribers is referred as ROOM management.

5.2.1. Functional Architecture

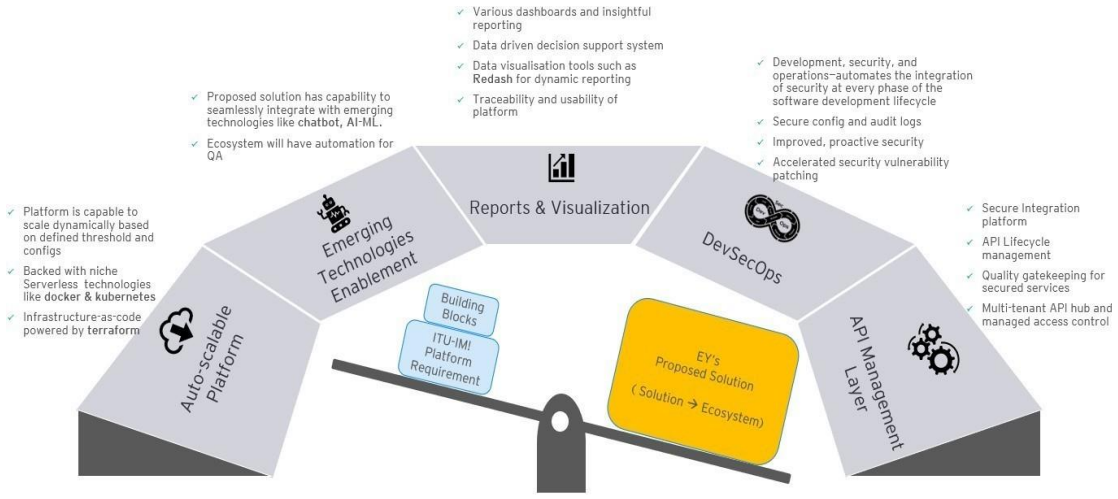
IM-BB or information mediator building block is composed various functional modules and enabler modules supported by a layer of virtualization container to manage the deployment of software modules. The below diagram represents the logical layers which would constitute the IM-BB module.



Picture 2 – Functional Architecture

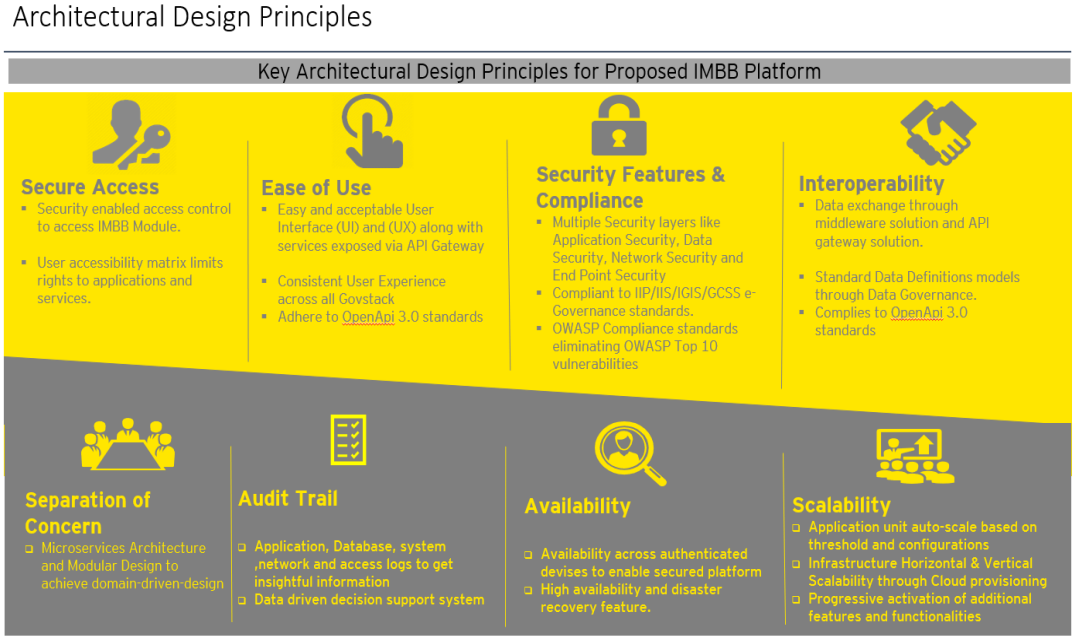
5.2.2. Key Differentiators and Design Principles

Differentiators



Picture 3 – Key Differentiators

IM-BB from conceptualization to deployment would have multiple checklists and rules that would to be followed. These are architectural, design and provisioning patterns which would be the guiding principles during the design and development lifecycle.

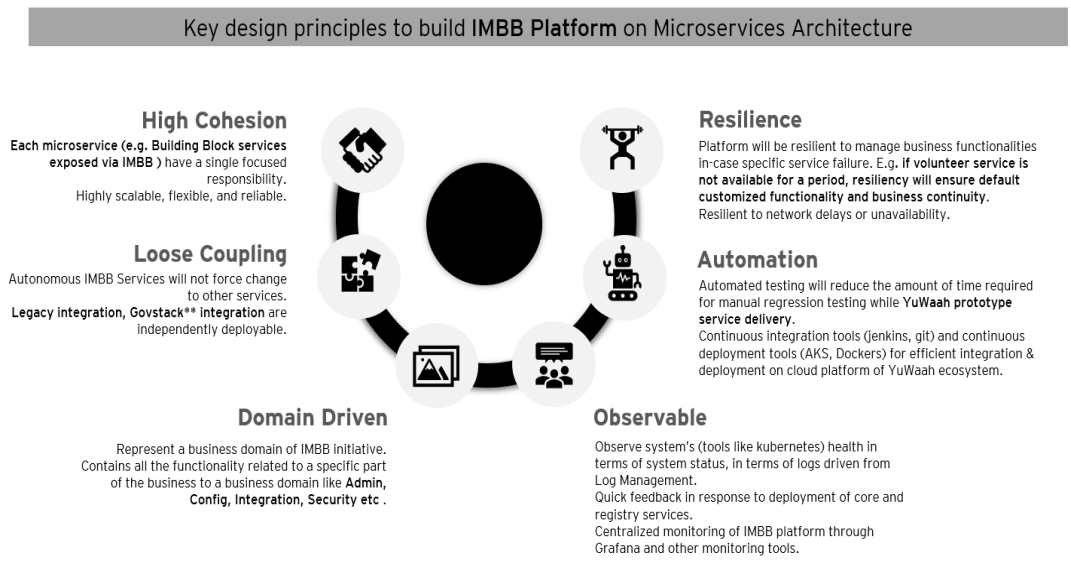


Picture 4 – Design Principles

5.2.2.1. Microservices architecture principles & sandbox design

The proposed IM-BB solution is meant to provide high volume service delivery, service orchestration and integration through different building blocks under highly available and auto-scalable containerized infrastructure platform. The solution will primarily cater the requirement of secure data exchange across various GovStack building blocks, external applications and legacy systems.

IM-BB platform architecture is a multi-layered one involving different set of technologies such as API Management, Distributed streaming (Kafka), RDBMS etc. to support event driven secure interoperable platform. The platform also leverages and manages the different technology stacks for implementation and integration of services and applications. The deployment and management of **microservices** will be essential part of IM-BB platform. Deployment of IM-BB components will be based on enterprise level microservice based architecture.



Picture 5 - Microservices Principles

The microservice architecture covers and represents following capabilities:

- Microservices Supported Tools and Technologies
- Cloud Capabilities

✓ **Key Characteristics and Potential Benefits of using Microservices**

- **Proved scalability** - Each IM-BB component independently scale services up or down, the ease—and cost—of scaling is dramatically less than in a monolithic system. Adding new capabilities usually means adding discrete new microservices, not redoing the entire ecosystem, which increases both development speed and application stability.

- **Better fault isolation** - If one of the microservices of IM-BB fails, all the others will likely continue to work. This is a key part of the microservices architectural design.

- **Optimized scaling decision** - With microservice architectures, scaling decisions can be made at a more granular level, allowing more efficient system optimization of IM-BB platform.

- **Increased business agility**- Microservices will be relatively small and simple, and failure of a microservice affects only that service—not the whole IM-BB application. This architecture principle will give GovStack as whole a freedom to experiment and "fail fast."

- **Simplified debugging and maintenance** - For the complexity reasons that building individual microservices is easier than coding for a monolithic architecture, developers can be much more productive when debugging code and performing maintenance.

- **Future-proofed applications** - Microservice architectures will makes it easier to respond by replacing or upgrading the individual services affected without impacting the other components of IM-BB platform.

- **Define the Communication Protocol between Layers and systems** - This principle allows us to define how the IM-BB components will communicate with each other. In the present solution all internal communication will happen via REST or KAFKA. The system will have a ESB layer to handle protocols like REST, SOAP, Streaming.

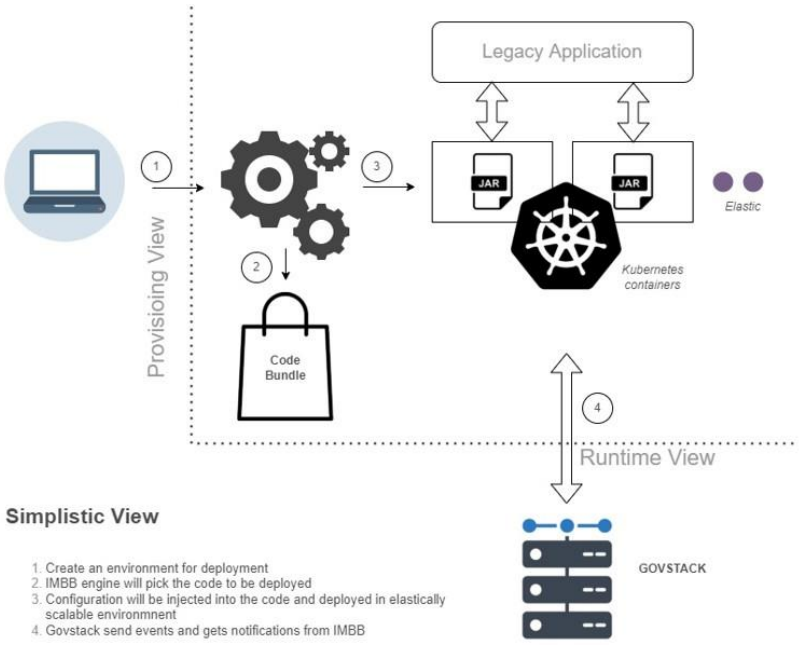
- **Sandbox driven solution design –** The core foundation of the proposed solution is to reduce the risks of failures by adhering sandbox environment enabled ecosystem.

Some key functionalities of sandboxed-environment based IM-BB solution as follows –

- Design for automation: Provisioning infrastructure, CI/CD, scale up and scale down, Monitoring will be built into the platform.
- Consistent State: Metadata and other session and event related data will be stored in fault tolerant datastores.
- Services Management: All the provisioning modules, config modules will be managed through REST Services.
- Continuous Improvements: The design of the platform would be such to allow continuous feature improvement without impacting deployed services.
- Reduce Single Point of Failure: Design would have redundancy built in place to avoid Single point of failure.
- 360-degree security view: Authentication and Authorization of deployed services, Hardening of OS and encryption of data in stores. Dev-Sec-Ops would enable 360 securities.

5.2.2.2. Architectural Pattern

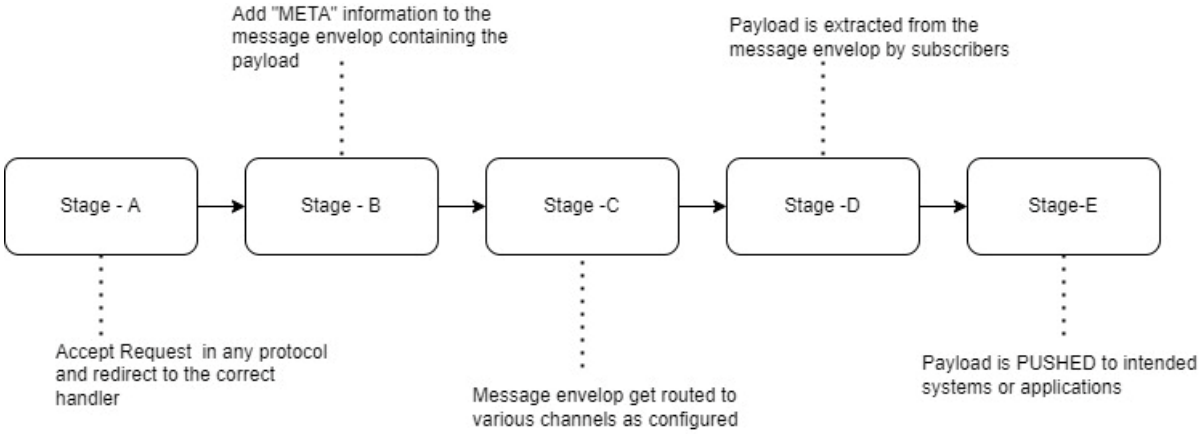
IM-BB or information mediator building block would act as a gateway for exchange of data between GovStack Building Block via open API REST based interfaces to ensure interoperability and implementation of standards.
IM-BB is envisioned as a modular, distributed container which can process events and messages coming to member local instances, a functional software already deployed in GovStack environment.



Picture 5 – Architecture Patterns

The idea to design IM-BB components to be deployed in containers is to ensure a standardized lifecycle management which can be independently provision and it can scale itself out when the demand increases. Another advantage is then the end user would only have to provision routing logic into the IM-BB component without thinking about other non-functional requirements.

As one of the core usages of IM-BB is going to be in facilitating event flow, the architecture principle is thus based on SEDA or staged event driven architecture. The event will be processed in various stages before it is pushed to applications (internal) or systems(external) subscribed to the event. Though the processing is happening in various stages, no transformations would be done on the payload.



Lifecycle of "payload" in IMBB container

As a core principle, messages/events should be processed in a staged manner and technical stack chosen to adhere the defined principles of event driven design. All pre-processing and post-processing components would be implemented in AKKA, and the event lifecycle management should be done by KAFKA.

AKKA is a toolkit which is based on the Actor Model which handles data by putting it in its message box and processing it by taking it out in a sequential manner. The design of AKKA is such that there is no shared memory amongst the actors thus avoiding a common pitfall as seen in threaded application. The other benefits of systems built in AKKA is as follows

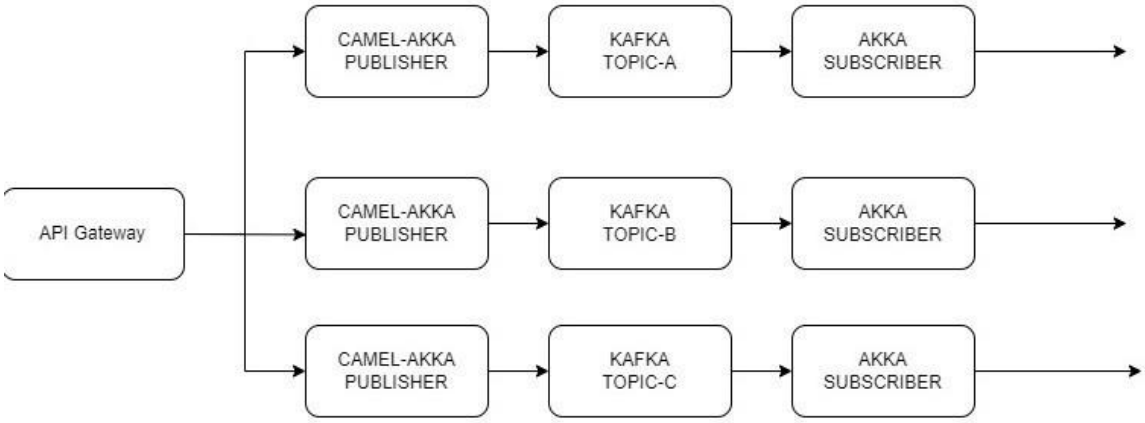
- Reactive and Handle back pressure.
- Simpler Concurrent & Distributed Systems
- Resilient by Design
- High Performance
- Handle streaming Data

A commodity grade hardware can host millions of actors which can all work parallelly without having to think about deadlocks and thread starvation which in an object-oriented world can cause unexpected behaviours and delays.

Actor Model has a supervisor mechanism which by organizing the actors into a hierarchy, we can have parent actors that manage child actors and delegate computations to child actors. By leveraging the actor hierarchy, it becomes very easy to make an application fault-tolerant and scalable. Moreover, AKKA's actor model provides the following features out of the box

- The actor can be transparently restarted after failure.
- The location of the actor is transparent, allowing AKKA to manage when and where the actor runs.
- The actor can maintain mutable state without worrying about concurrent access to this state.
- The actor model has built in FSM (Finite State Machine) which can manage workflows

The SEDA model chosen for this container adheres to the principles of separation of concerns, each "ROOM" would be a separately provisioned as shown below. A runtime view of the provisioned workflow depicted in a simplistic way below.

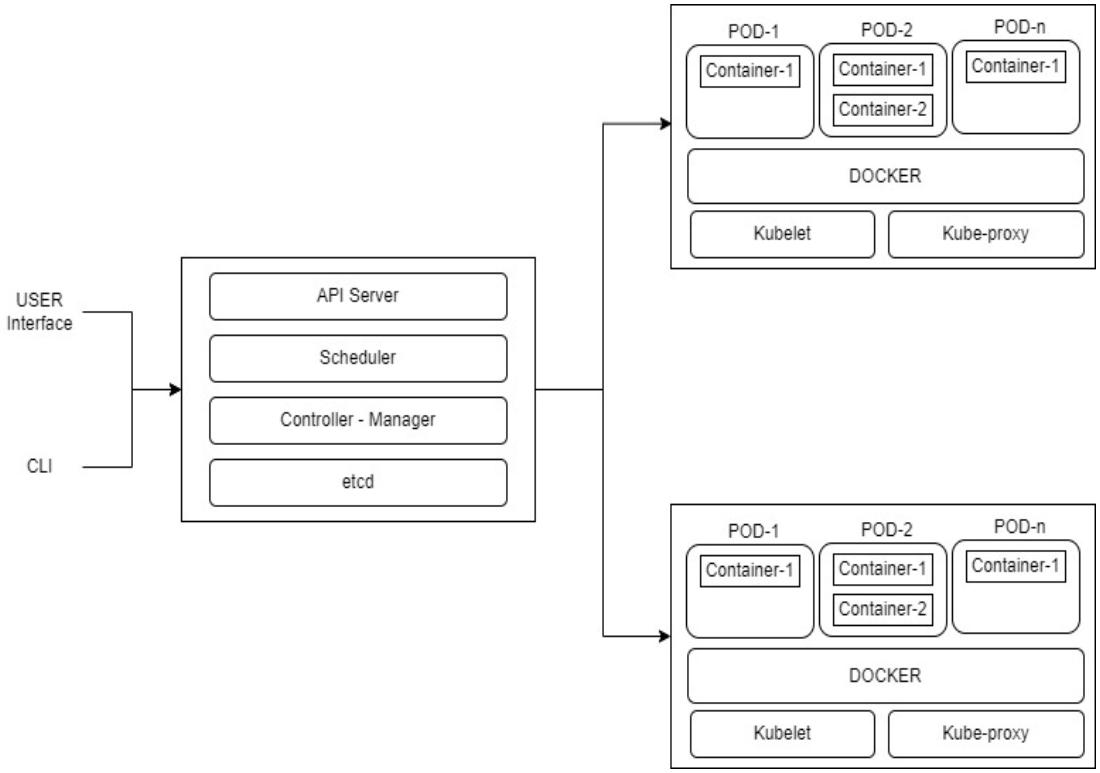


Runtime provisioning of "ROOM"'s message processing workflows

The broker module chosen for our solution is KAFKA which is distributed pub-sub messaging system that is to be fast, scalable, and durable with low latency. Some of the salient features of KAFKA as follows

- Kafka is highly scalable. Kafka is a distributed system, which can be scaled quickly and easily without incurring any downtime.
- Kafka is highly durable. Kafka persists the messages on the disks, which provides intra-cluster replication. This makes for a highly durable messaging system.
- Kafka is Highly Reliable. Kafka replicates data and can support multiple subscribers. Additionally, it automatically balances consumers in the event of failure.
- Kafka Offers High Performance. Kafka delivers high throughput for both publishing and subscribing, utilizing disk structures that can offer constant levels of performance, even when dealing with many terabytes of stored messages.

The other facet of our architecture which makes this solution decentralized and elastically scalable is the fact that the stack will be deployed on open-source container orchestrator like Kubernetes. This would abstract the solution from an infrastructure layer and provide on demand scalability or elasticity. The separation of concern in deployable architecture is possible because containerized module



5.2.3. Solution Building Blocks

Overall solution building block consist of –

- Admin Module
- Pub-Sub Model
- Event Management
- Integration Management
- Deployment & Automation
- Monitoring
- Scaling/Throughput

5.2.4. Technical Solutions and Open- Source Products

The most appropriate modern tech open-source stacks are considered to design the proposed solution, which will cover all business and technical functionalities requirements & will be used to build the IM-BB platform.

Module	Technology	Version	Reference Usability
ESB	CAMEL	2.17	Integration framework that empowers to quickly and easily integrate various systems consuming or producing data.
Microservices	SPRINGBOOT	5.3.19	Java-based framework used to create a micro-Service
BROKER	KAFKA	3.2.0	Open source distributed streaming system used for stream processing, real-time data pipelines, and data integration at scale.

Module	Technology	Version	Reference Usability
Stream Data Processor	FLINK	1.15.1	Unified stream-processing and batch-processing framework.
RDBMS	PostgreSQL	14.4	Relational database management system emphasizing extensibility and SQL compliance
Search-Engine	Elasticsearch	8.3.3	Elasticsearch is a search engine with distributed, multitenant-capable full-text search engine.
Configuration Mgmt.	Zookeeper	3.8.0	Centralized service for maintaining configuration information, naming, providing distributed synchronization, and providing group services.
Gateway	APISIX	2.15.0	API Gateway which provides rich traffic management features like Load Balancing, Dynamic Upstream, Canary Release, Circuit Breaking, Authentication, Observability.
Log Management	ELK	8.3.3, 7.13.2, 8.3.3	Collection, parsing, and storing logs for future use. Kibana is a web interface that can be used to search and view the logs that Logstash has indexed.
IAM	Keycloak	19.0.1	Identity and Access Management aimed at modern applications and services.
Container Management	Docker	20.10.17	Open-source container management tool to deliver IM-BB components in packages called containers
Auto-scalability	Kubernetes	1.24	Open-source container orchestration system for automating software deployment, scaling, and management.
Mediator Framework	AKKA	2.5	Actor Model based toolkit and runtime simplifying for concurrent and distributed applications on the JVM.
Monitoring	Grafana & Prometheus	9.0.6, 2.37.0	Application Monitoring Systems and visual reports of monitoring stats.
Front End	React.js	18.1	JavaScript library for building user interfaces based on UI components.
Security Server	WireGuard	1.0.202	Communication protocol that implements encrypted virtual private networks and security server.
JDK	Programming Language	1.8	Object oriented programming language
Scala	Programming Language	2.12	Functional programming language built over JVM

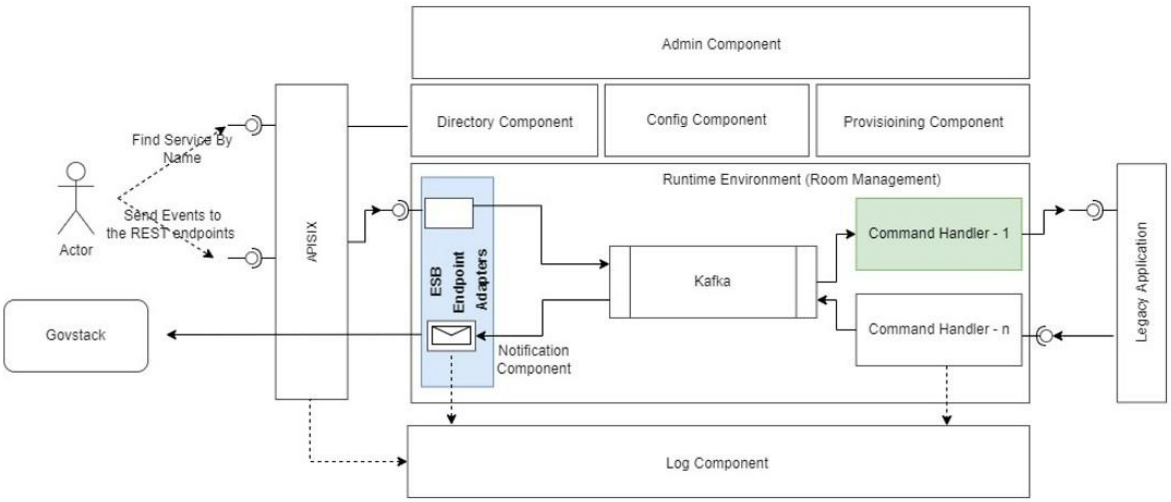
Picture 6 – Technology Products & Solutions

5.2.5. Information Mediator Building Block (IM-BB) Functions

The main functions and different modules of IM BB are described in subsequent sections.

5.2.5.1. Service Access Layer

The Service Access Layer is a conceptual layer that provides access to the IM-BB module. The layer comprises of many modules which have a specific modality in making the access to the core components like administrative interface, administrative user roles etc.



Key Digital Functionalities mapped with proposed IM-BB solution functional reference.

Functionality	Approach
Routes requests to the correct provider	The request is intercepted by API Gateway (APISIX) which will route it the appropriate Endpoint Adaptor. The Endpoint

	Adaptor will post it the configured topic and for every topic there will be a Command Handler which will forward it to the correct application
Connects the service requestor to the service provider and its underlying solution platforms, realizing the requested service	API Gateway (APISIX) and Runtime environment will ensure the service requester is connected to service provider (provided the configuration in room management is correct)
Discovers services and, at runtime, to support the virtualization of services, so that changes to endpoints can occur without impact to service consumers and service providers	Directory Service will provide with the abstraction and Runtime Environment will provide the virtualization of the service pipelines where mutually exclusive "Endpoint Adaptors" and "Command Handlers" can exist (change in one pipeline will not impact other running pipelines)
Enforces access privileges and other security policies	IAM component will facilitate RBAC, and security server will enable secure access to services by defining and enforcing policies and guidelines.
Maintains service invocation history and monitors and tracks service invocations	Every message will get associated with a unique message ID and can be tracked in the Log Management Component / Module
Provides broadcast/multicast capabilities to facilitate faster, more resilient application design	Command Handler will get a Message Envelope (Payload + Meta Data) based on endpoints configured, Payload can be sent to multiple endpoints

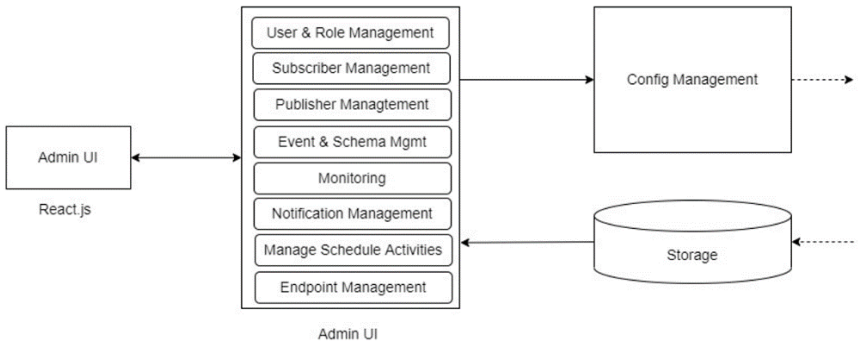
An overview of the core modules is given below.

5.2.5.1.1. Administrative Interface

Administrative Interface consist of major functionalities described below.

- **Admin Management**

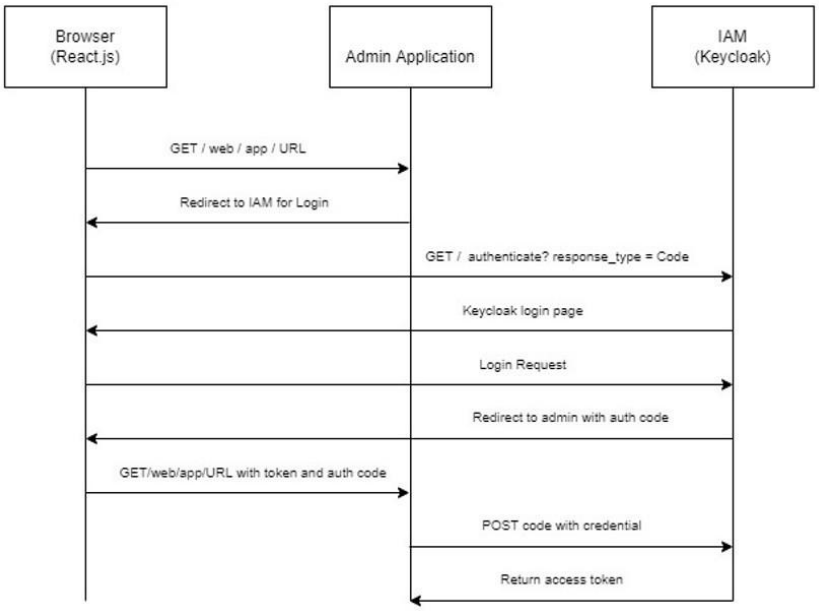
Admin Module is the gateway for managing the IM-BB module. This module will expose a minimalistic GUI to manage the following capabilities in a managing tenant also socialized as Room Management.



- **User and Role Management**

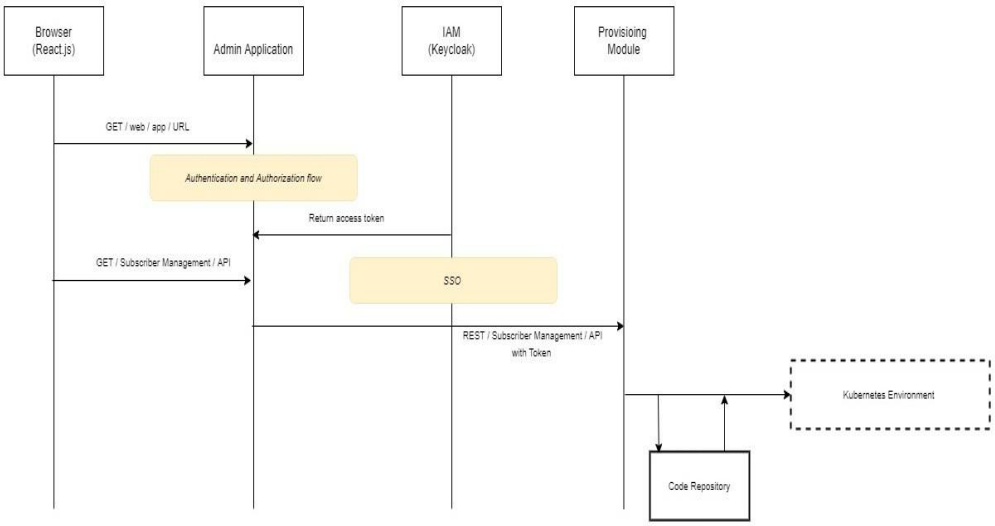
  User and Role Management is key in managing users who will provision Rooms and manage it. Each user will have a specific role and perform activities as per the requirements of the system. IAM (Identity and Access Management) will be the backbone managing authorization and access management. The system will have a super user who will be responsible for providing access to

another users. So, in a way, admin or a super user will create and manage other stake holders. The Admin GUI will have components as mentioned above and will have authorization associated with it.

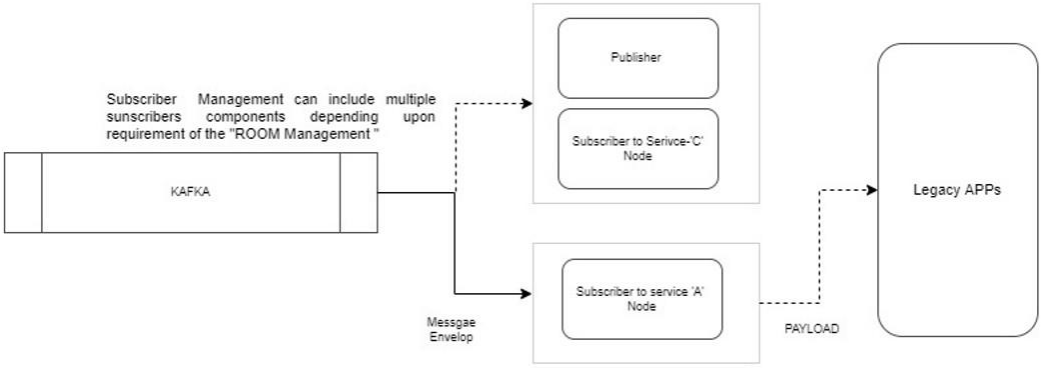


- **Subscriber Management**

  Subscriber Management is the component will be responsible for setting up the user to manage the endpoints. The endpoints will be responsible for accepting the business events from KAFKA. Along with configuring the events for the subscriber management, it will also configure the exchange component i.e. (manage fan-out of business events). A brief overview of the subscription provisioning is depicted below.

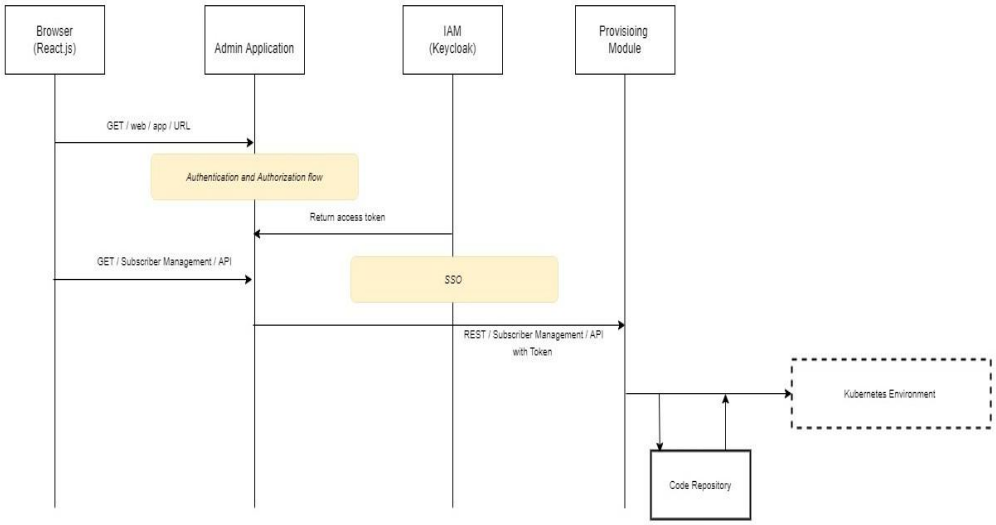


The subscriber management will also configure the Kafka (Broker) endpoints to consume business events from. A direct communication of Kafka with legacy is not envisioned since depending upon the meta data the flow needs to be orchestrated upon which is possible with subscriber management.

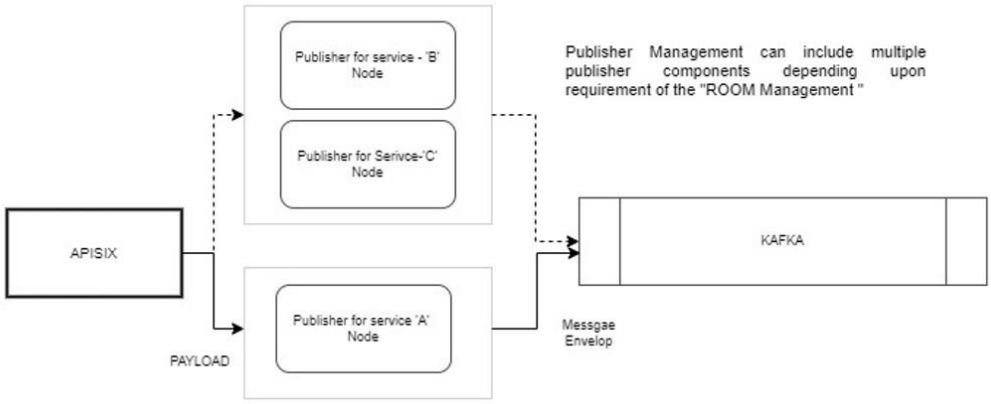


- **Publisher Management**

  Publisher Management is the component will be responsible for setting up the user to manage the endpoints (Similar to the way done in subscriber management). The endpoints will be responsible for accepting the business events from APISIX.



The publisher management will also configure the Kafka (Broker) endpoints to act like event sink. A direct communication of API gateway is not envisioned since the Meta data needs to be injected along with payload into the message envelop.



- Manage event types, schema
- Monitoring
- Notifications Management
- Manage Schedule Activities
- Endpoint Management

Furthermore, an administrative interface shall be provisioned for admin to manage security-server configuration. A ReactJS based application shall be built to facilitate admin stakeholders to configure and manage the security server. The admin interface for Security-server configuration consists of –

- Members
- Applications
- Services

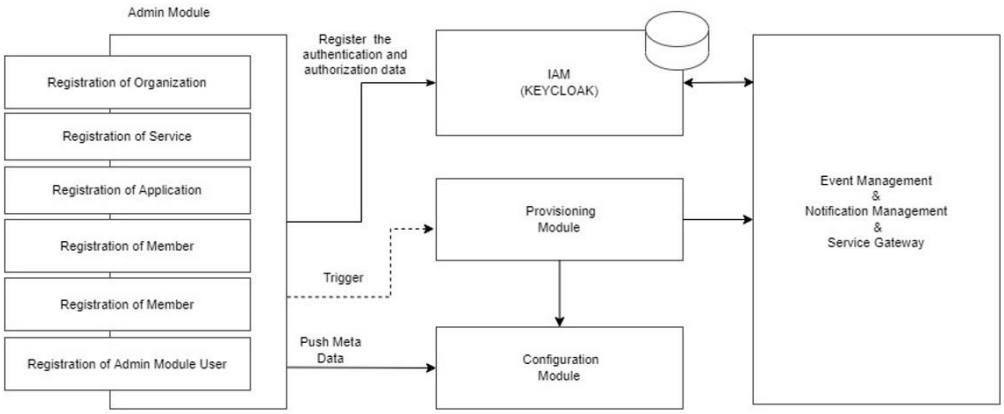
5.2.5.1.2. Administrative User Roles

Administrative User Roles will be managed by Keycloak as an Identity and Access Management for IM-BB, GovStack BB client apps and other integrating services. The goal of Keycloak is to make security simple so that it is easy for application developers to secure the apps and services will be deployed in IM-BB. Security features that need to be configured will have to be written are provided out of the box and are easily tailorable to the specific requirements of IM-BB application. Keycloak provides customizable user interfaces for login, registration, administration, and account management. Below are the features which will be used

- Single-Sign-On and Single-Sign-Out for browser applications.
- OAuth 2.0, OpenID Connect & SAML support.
- Identity Brokering - Authenticate with external OpenID Connect or SAML Identity Providers.
- User Federation - Sync users from LDAP and Active Directory servers.
- Admin Console for central management of users, roles, role mappings, clients, and configuration.
- Account Management console that allows users to centrally manage their account.
- Theme support - Customize all user facing pages to integrate with applications and branding.
- Login flows - optional user self-registration, recover password, verify email, require password update, etc.
- Session management - Admins and users themselves can view and manage user sessions.
- Token mappers - Map user attributes, roles, etc. how admin stakeholder want into tokens and statements.
- Not-before revocation policies per realm, application, and user.
- Service Provider Interfaces (SPI) - Several SPIs to enable customizing various aspects of the server. Authentication flows, user federation providers, protocol mappers and many more.

5.2.5.1.3. Registration

Registration is core to introducing and managing lifecycles of apps, service, and users into IM-BB. There are multiple entities that get registered and managed through this use case. During registration meta data is also captured into configuration module. There are various attributes that are captured during the process of registration that are stored apart from IAM in configuration module.



Registration of Member: Some of the attributes (not limited to this) shall be captured while registration of member include.

- Organization Name
- Certificate of member
- Access to signing key
- Publish IP of external security server

Registration of Application: Key attributes (not limited to this) shall be captured while registration of application include.

- Application name
- Certificate of transportation key

Registration of Service: Key attributes (not limited to this) shall be captured while registration of application include.

- Description or Meta data associated with service
- List of enabled endpoints

Registration and managing list of consumers of service: attributes (not limited to this) shall be captured while registration of application includes.

- Endpoints of the service
- Endpoints of the Application

Registration of admin and room management users: Some of the attributes captured while registration of application includes. This will pay no role in runtime of business event flow.

- User credentials
- Web component user can access

5.2.5.1.4. Accessing Services

Accessing Services via IM-BB is core to business functionality of the design of this module. There are various attributes that need to be captured to make a service accessible. These attributes are as follows

- Security Server URL
- API version
- Country

- Domain of the member
- Application
- Service
- Path (Endpoints & Query Parameter)

5.2.5.1.5. Directory Services

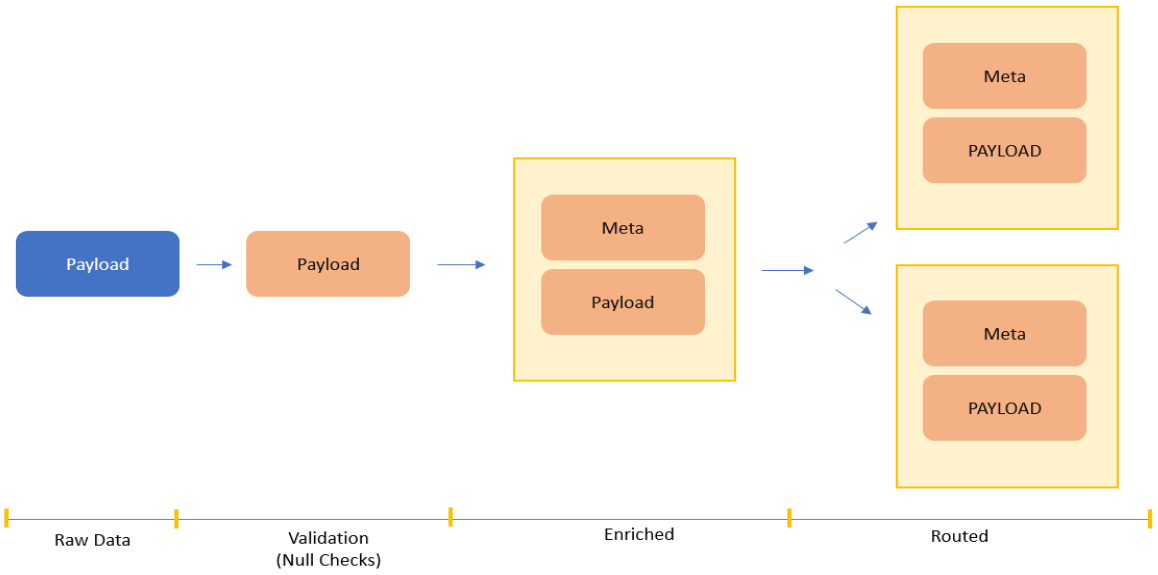
Directory Service is an openly available service which when requested upon can provide an array of services registered, attributes along with the description associated with it. Here the description would include list of allowed methods.

This service would be of help during development and testing as it would contain all the services a particular IM-BB has to offer with the ones registered.

5.2.5.2. Pub-Sub-Layer

Event Management: IM-BB's proposed solution is envisioned to be built on SEDA (staged event-driven architecture) for business events processing. The event which flows through the pre-built pipelines need to be configured as per business scenario. The events undergo various stages before it is consumed by the target system. Each stage mentioned here has a specific purpose which it undertakes to enable the business purpose.

Journey of Business Events in IMBB



- Validation stage: This stage contains the checks configured for making sure certain attributes (i.e., schema, headers etc.) are validated before processing starts.
- Enrichment stage: This stage creates a message envelop which introduces a meta data along with the payload. The meta data is the pipeline configuration embedded into the object which moves along with Payload but holds the key to how the payload will be interpreted by the system.
- Routing stage: This stage includes the business events getting orchestrated across various endpoints based on the configuration. The endpoints will be embedded into the meta data which will be used in the routing stage

5.2.5.2.1. Key Concepts

Event-driven architecture of proposed IM-BB solution should be designed that connects distributed component of building block and allows for efficient communication. EDA makes it possible to exchange information in real time or near real time. Key consideration of following this design as proposed solution is conceptualized to be built on microservices.

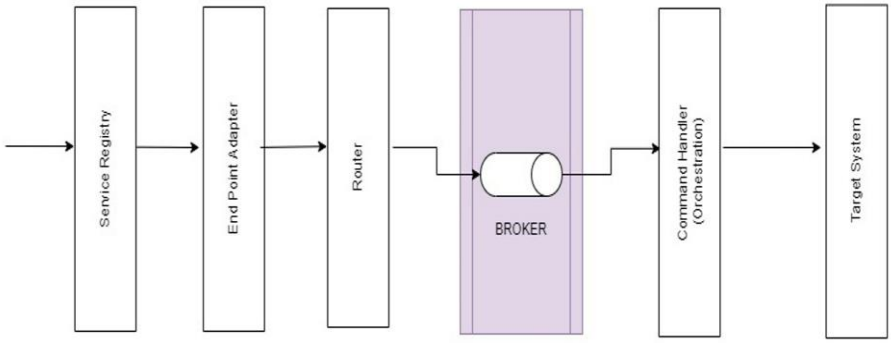
The concept of event-driven architecture is mainly realized through the publish/subscribe communication model.

- **Service Registry:** This component acts as the gateway to the pipeline configured.
- **End Point Adapter:** This component extracts the payload and wraps it in a 'Message Envelope'. Message Envelope is a composable object that introduces a meta component along with payload. The meta component discussed here contains meta information such creating time, other endpoint configurations.
- **Router:** This component is responsible for directing the Message Envelop based on the topic configured in the Meta component.
- **Command Handler:** This component is the subscriber who is bound to a topic. Upon getting the Message Envelop depending upon the endpoints configured, the command handler will push the payload to the registered endpoints. The payload will be extracted out of the Message Envelope before pushed to all the target systems.

There are key common patterns which Event Management Pipeline will adhere to while configuring the pipelines

- Exchange Pattern - Exchange Pattern is a complimenting pattern as compared to rest of the described message flow patterns. This pattern focuses on the endpoint level where the messages need to be "fanned-out" to various consumers.
  As transformation of the message is out of scope (this capability will not be provided at the time of configuration), the capability which will be provided out of the box is configuration of multiple consumers for a response. This pattern can be configured all the above message flow patterns.

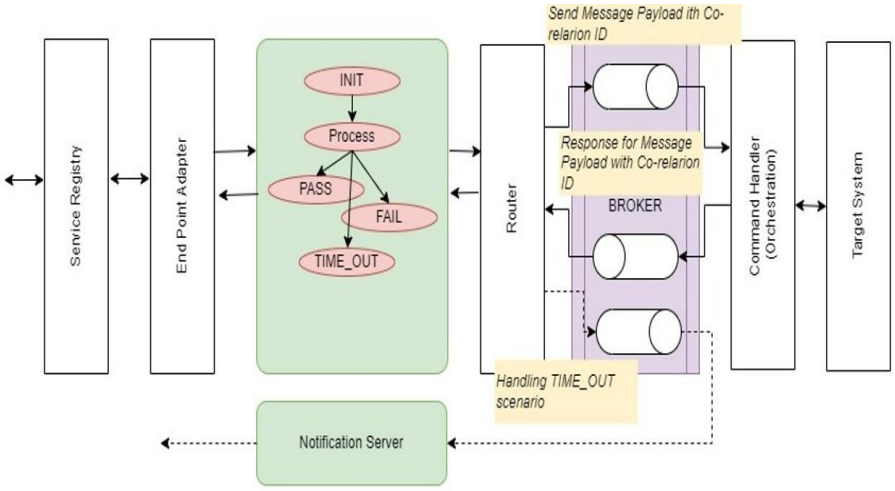
- Fire and Forget Pattern - is the most common pattern deployed using a broker. This pattern uses an asynchronous way of sending data without waiting for a response. This pattern involves a queue (part of broker) which becomes the message sink for all the publishers (internal and external). The depicted pattern involves the components with the following responsibilities



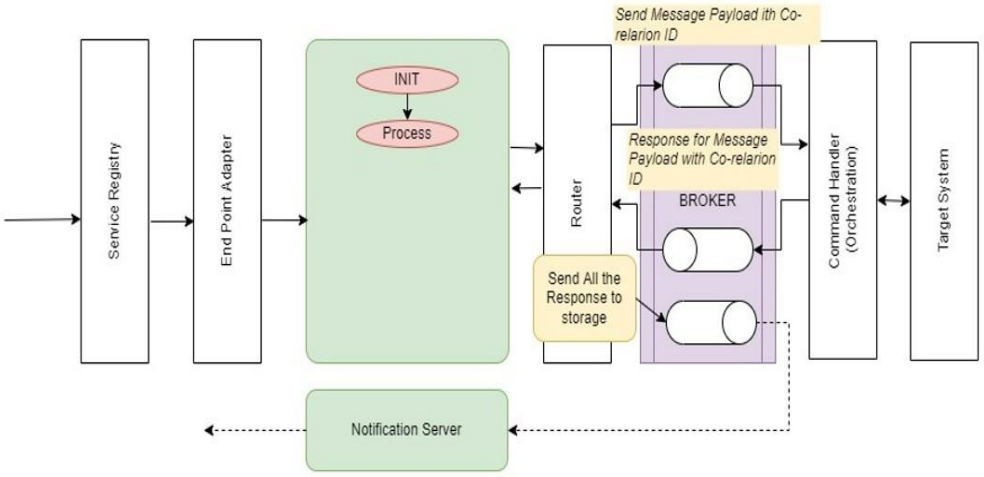
- Half Synch-Async Pattern - when the client app interacts in a synchronous way, but the interaction with client app and back-end is asynchronous. This pattern uses an asynchronous way of sending data to the target system but waits for a response. The request in the broker is

sent along with a correlation ID which the receiving system uses to responds back. A time out is also registered within time frame to respond back to else the response is put in a time out queue. The timed-out messages can be sent to the awaiting system via a notification system.

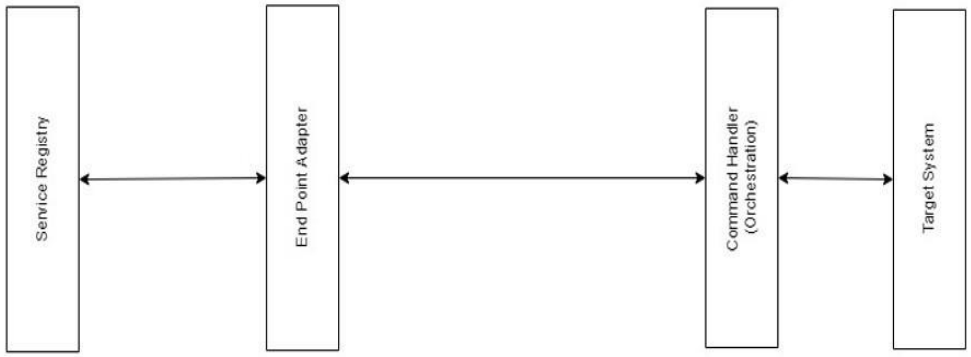
There are two further configurations that can be done in this pattern for the pipeline deployed. If requesting system does not want a synchronous communication and cannot wait but requires a notification then the time out can be set as zero, in which case a notification can be sent via a separate channel. If the requesting system is a synchronous system, then as per the SLA a time-out can set. In this case also on time-out a notification system will send the response to the end point configured.



- Asynchronous with Bulk Notification Pattern - when the front-end sends a payload and reconciles with the results or response at a later part of the day.



- Synchronous Pattern - Request-Response pattern is an interaction where the requesting system will wait for the response from the target system.

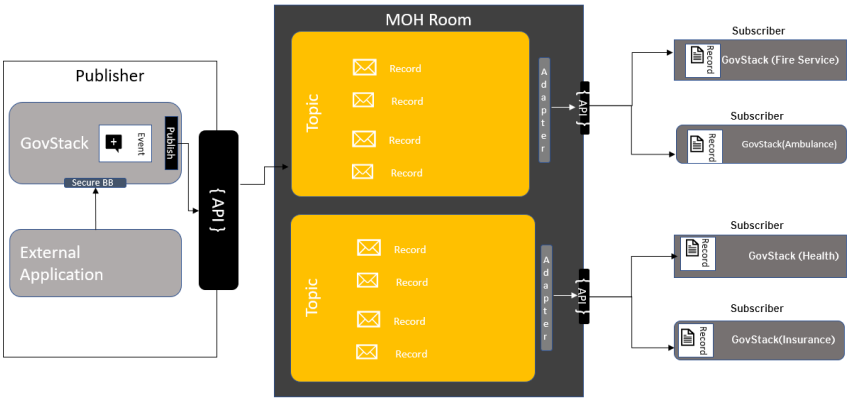


5.2.5.2.2. Facilitating Publish/Subscribe

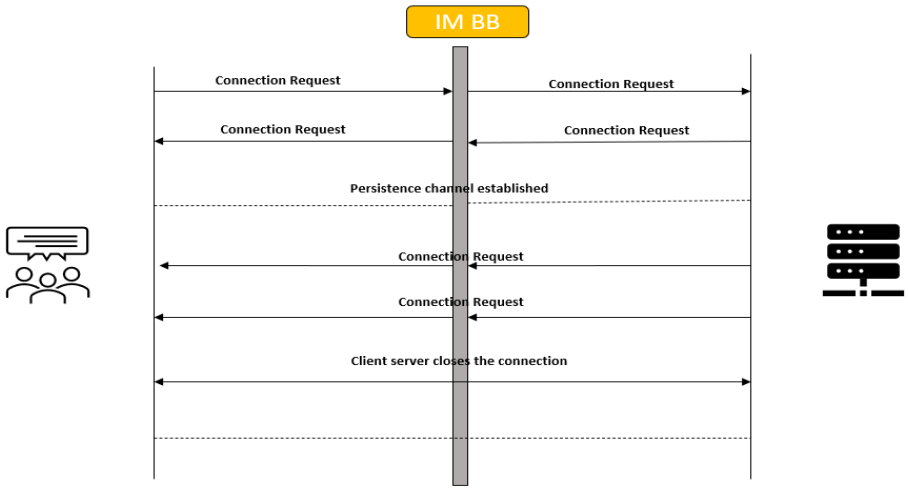
Facilitation of events focuses on the endpoint level where the message needs to fan out to various consumers. As transformation of the message is out of context (this capability will not be provided at the time of configuration), the capability which will be provided out of the box is configuration of multiple consumers for a response. This pattern can be configured all the above message flow patterns.

The Data exchange pattern supported by various models; the models described as follows

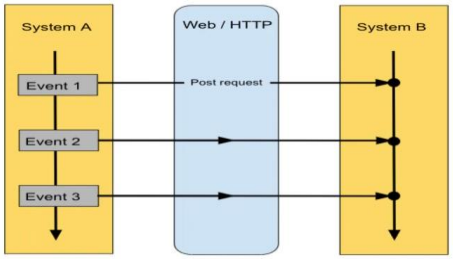
- Pub-Sub Mode
  - **Publisher:** To broadcast a message, a component called a publisher simply pushes a message to the topic, which batch messages until they are retrieved, message topics transfer messages with no or very little queuing and push them out immediately to all subscribers.
  - **Subscriber:** An application with a subscription to a single or multiple topics to receive messages from topic.



- Stream Processing
  - **Server-Sent Events (SSE)** are suitable for scenarios where the client is subscribed to the server and the client requires to receive event streams without communicating with the server as the protocol is unidirectional. The client initiates the HTTP connection channel, where it is responsible for re-creating the connection in case it closes because of an error. The server is responsible for pushing asynchronous event streams to the channel and closing the connection if required.



- **Webhooks** are more relevant for use-cases such as firing notifications in reference to an event occurred at GovStack Building Block Component. IM-BB will utilize the WebSub protocol to implement Webhook streaming APIs. It works as a low-scaled hub in the architecture.



5.2.5.2.3. Defining Message Types

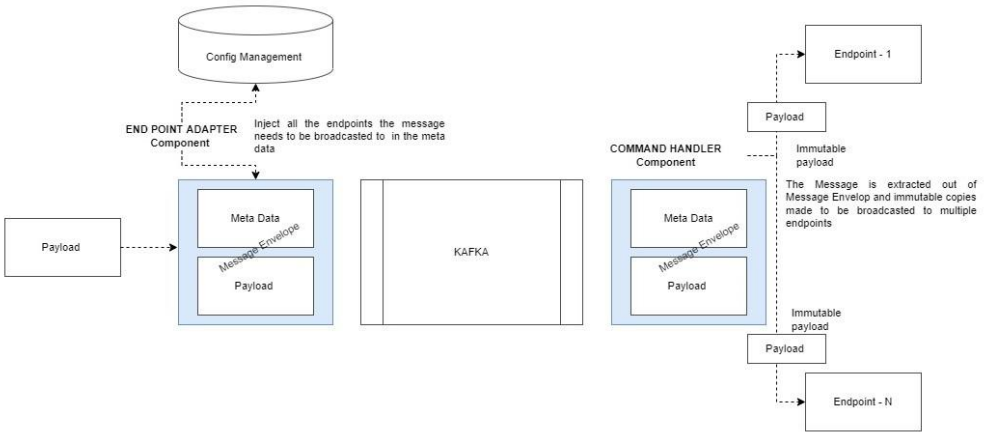
As event management is the core of "ROOM" Management during runtime, there are multiple activities that this module will need to do during the flow of event.

- Convert from raw payload to Message Envelop. Message Envelop is the container which will wrap this raw payload along with extra meta message.
- Route to the correct message processing handler.
- This message handler along with configured publisher will route to the appropriate Queue.

The subscriber will at this point will pull the Message Envelope and route to the correct end point. Regarding subscriber the following can be configured in Room Management.

5.2.5.2.4. Broadcasting a Message

The subscriber can fan-out or broadcast messages to multiple endpoints as configured. The multiple endpoints can be configured and would form part of Meta Data that will be part of Message Envelop that will get formed. The diagram below represents the journey of the message as it gets converted to Message Envelope by Endpoint Adaptor (A component developed to enrich Message Envelope with information like creation time, destination endpoints etc.)



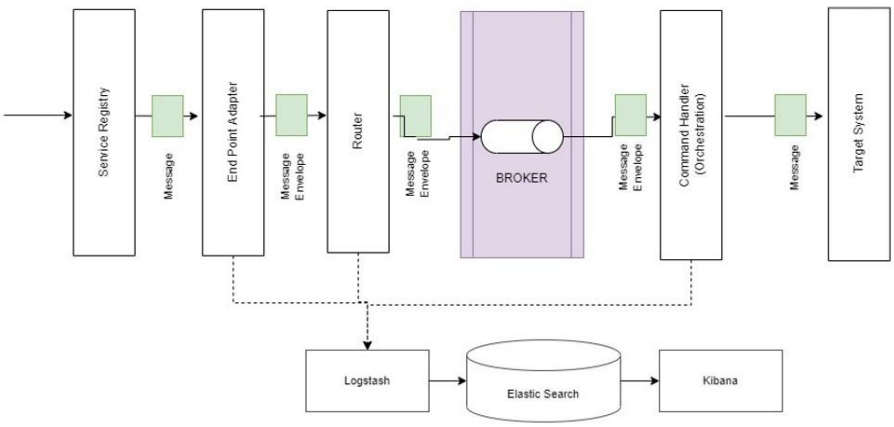
Exchange Pattern which will come preconfigured with capability which will enable broadcasting of messages. The Endpoints covered here can be web-based application (REST based), Kafka queues etc. Adaptors for these protocols will come pre-packaged along with the solution. So, while setting up a subscriber the command handler can be configured to perform broadcasting of message. Another responsibility of Command Handler is to create immutable copies of message which will be sent to all the destination.

Akka the framework used to develop command handler has a built-in capability to distribute a message amongst multiple actors parallelly which will be responsible for broadcasting the message. Another advantage would be in case the message is unable to get delivered to a host then multiple retries can be configured by persisting the message.

5.2.5.2.5. Maintaining and Displaying Message Logs

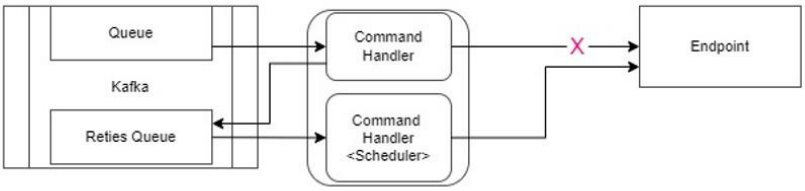
The subscriber will have to log all preconfigured actions for better traceability. Subscribers, the runtime owner of a pipelines will involve many components which starting from consuming a message, enriching a message to delivering a message will start with associating a unique ID to a message. This unique ID will be attached to Meta Data in Message Envelope as existing payload cannot be transformed. At every step or action therefore performed will get logged and a traceability would be maintained via unique ID.

The log generated will be pushed into Elasticsearch and viewed upon querying Kibana. Entire trail can thus be displayed



5.2.5.2.6. Retying Message

Retrying Messages is a QoS (Quality of Service) which enables at least delivery on message once in case endpoint is not reachable or un-available. The behaviour of the system is to put the message back in the "Retries Queue" with a count attached it in the Meta-Data of the Message Envelope. The messages in the "Retries Queue" will be picked in scheduled way and delivery will attempted or put back into the "Retries Queue" till the time the "Retries" get exhausted.



5.2.5.2.7. Registering/Updating/Deleting a Subscription

Every Room Management will have multiple pipelines configured. For every pipeline there will be multiple subscribers. Room Management will have the capability manage Subscriber Lifecycle Management. Room Management can be viewed as a tenant in the IM-BB ecosystem. Each tenant here will have its runtime environment.

Registering, Updating or Deleting a subscriber in the IM-BB requires three perspectives to be taken care of

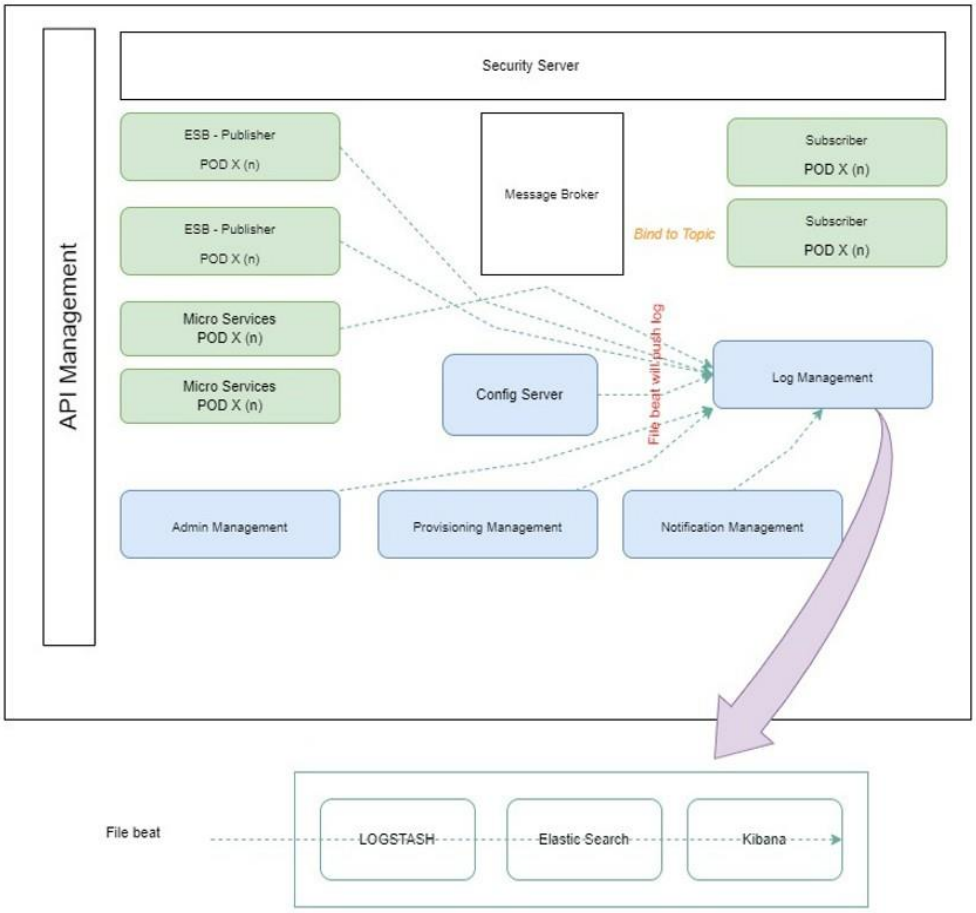
1. Management of the executables with configurations for the pipeline
2. Management of the infrastructure for the subscriber
3. Management of the entries in the security server and API gateway regarding subscriber.

5.2.5.2.8. Message Receipt/Delivery Logging and Audit Trail Generation

Subscriber will have to log Message Receipts to ensure information trail is maintained and also to delete messages from persistent storage once the message is consumed. (The details of logging and audit trials are explained in Log Management section)

5.2.5.3. Log Management

This module will be responsible for collecting logs, push it to log repository which can then be used to analysis. The module will have a workbench for writing queries which can then be used get real time awareness of the pipelines. The module is backed by ELK.



Picture 7 – Log Management Overview

Proposed ELK tech stack is a powerful collection of three open-source tools:

- Elasticsearch
- Logstash + File beat
- Kibana

These different products will be used together for log analysis in IM-BB across different environments. Using ELK Stack, ecosystem stakeholders can perform centralized logging which will help in identifying the problems with the application servers or applications. It will allow to search through all the logs at a single place and identify the issues spanning through multiple servers by correlating their logs within a specific time frame.

5.2.5.3.1. Log Maintenance

Log maintenance of IM-BB components oversees important activity within infrastructure, inspects events, detects errors, logs user actions, and provides alerts in the event of a data breach or abnormal behaviour.

Effective log monitoring systems rely on centralized log data that are well indexed to be, quickly searchable and provide real-time alerts about important events. These events don't just have to be for root cause analysis but can also be used to gain insight into critical events such as server warnings, HTTP errors, performance, abandonment, and others.

Log management outlines the critical scope such as:

- Log collection
- Log data ingestion
- Search & analysis
- Log monitoring & alerts
- Visualization and reporting

5.2.5.3.2. Audit Trail

The guideline applies to all components of IM-BB that handle workflows, services, accept network connections, access control (authentication and authorization).

Underlying requirements – IM-BB components shall record and retain audit-logging information sufficient to answer the following questions:

- What activity was performed on IM-BB?
- Who or what performed the activity, including from where or from which system the activity was performed?
- When was the activity performed?
- With which program(s) was the activity was performed?
- What was the status (such as success vs. failure), outcome, or result of the activity?

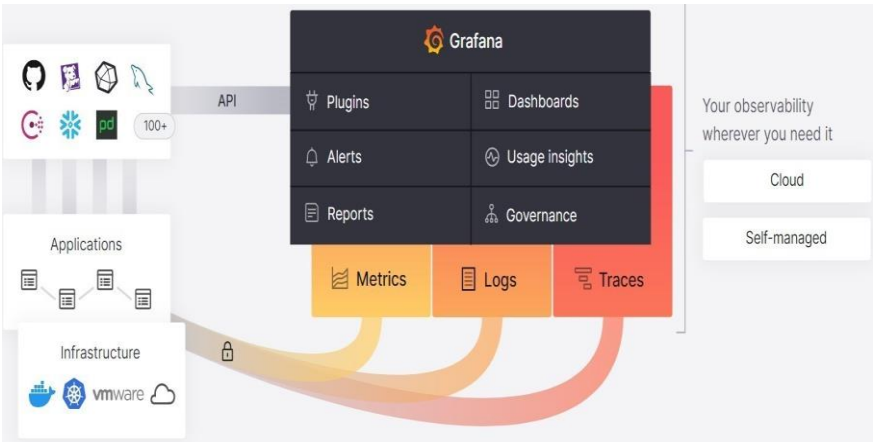
Activities to be logged - Logs shall be created whenever any of the following activities are requested to be performed by IM-BB:

- Create, read, update, or delete on Protected or Sensitive information, and authentication information such as passwords
- Initiate/Accept a network connection
- User authentication and authorization for activities covered in #such as user login and logout
- Grant, modify, or revoke access rights, including adding a new user or group, changing user privilege levels, changing file permissions, changing database object permissions, changing firewall rules, and user password changes

5.2.5.4. Monitoring

With many loosely coupled IM-BB services collaborating, things are bound to go wrong in ways that are difficult to detect in test environments. As a result, it's essential that a monitoring regime is in place to detect serious problems quickly. Detecting technical issues (counting errors, service availability, etc) but it's also worth monitoring business issues (such as detecting a drop in service invocation).

Proposed solution uses open-source tech solutions like Grafana, Prometheus for monitoring of overall IM-BB solution.



Picture 8 – System Monitoring

5.2.5.4.1. Operational Monitoring

The Operational monitoring dashboard provided by monitoring tools are stacks of dashboard anti-patterns. It's big and complex, doesn't use jsonnet and displays far too many metrics in one place. For just getting started the Reads, Write and Resources dashboards to monitor operations in an opaque way.

The dashboard mainly includes repo for two reasons:

- It provides a stack of metrics for other operators to consider monitoring while running.
- IM-BB's internal infrastructure

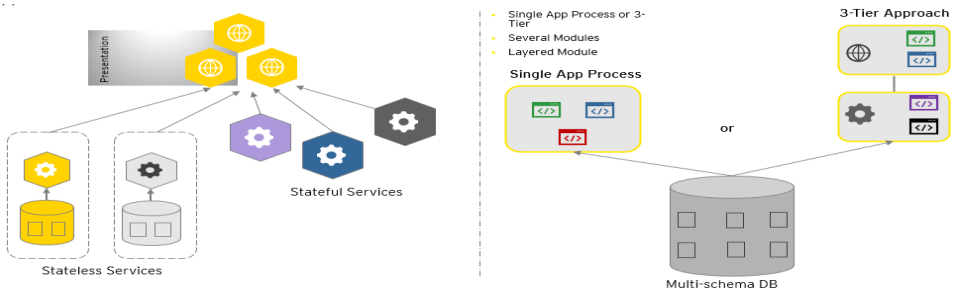
5.2.5.4.2. Environmental Monitoring

Proposed IM-BB solution focuses on Compose and scale observability with one or all pieces of the stack. The environmental monitoring covers monitoring of –

- Components of IM-BB building blocks (Applications)
- Infrastructure such as virtual machines, containers, cluster nodes
- Cloud / on-premises observability

5.2.5.5. Scaling/Throughput

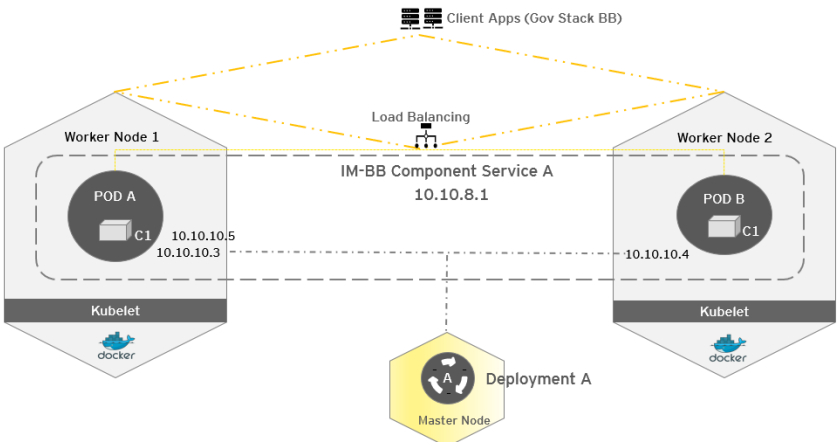
Scaling throughput and performance are critical design consideration adopted for proposed IM-BB's distributed architecture. IM-BB solution design supports both, scaling them up and down at the same time horizontal and vertical scaling to enhance performance.



IM-BB components will be scaled as bundled applications (containers) to achieve better horizontal scalability while load increases on the platform and automatically reduces the resource utilization by reducing number of replicas in-case load on the platform decreases. However, IM-BB proposed solution design caters vertical scalability by adding more resources (core, RAM etc.) typically in certain scenarios like RDBMS.

5.2.5.5.1. High Availability

Proposed technology platform for deployment "Kubernetes High Availability" ensures that Kubernetes and its supporting components have no single point of failure. A single master cluster is vulnerable to failure, but a multi-master cluster uses many master nodes, each having access to the same worker nodes.



IM-BB component running on single container that container can easily fail. Same as the virtual machines for high availability in Kubernetes we can run multiple replicas of containers. In Kubernetes, to manage the multiple replicas we use deployment this is a type of controller.

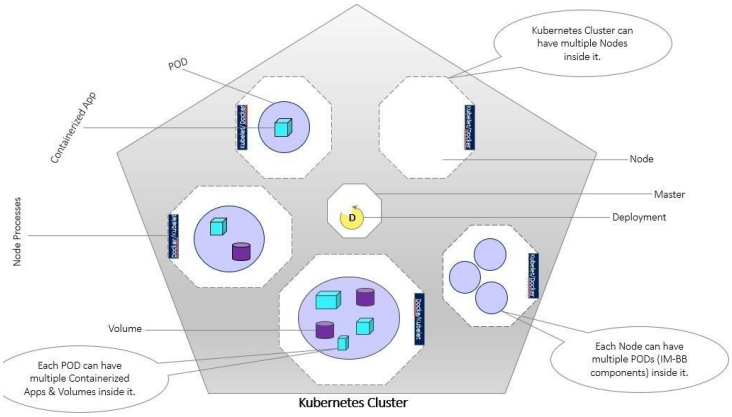
5.2.5.5.2. Auto Scaling

Kubernetes cluster shall be used to deploy containerized applications on top of it using Kubernetes Deployment Configuration to achieve auto-scalability for IM-BB components. Once deployment configuration has been created, Master schedules core platform applications instances onto individual Nodes into the cluster.

Once the application instances are created, Kubernetes Deployment Controller continuously monitors those instances. If the Node hosting an instance goes down or is deleted, the deployment controller replaces it. This provides a self-healing mechanism to address machine failure or maintenance.

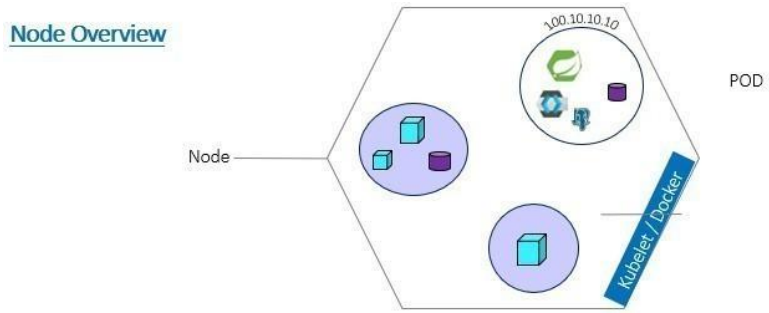
- **Cluster**

A kubernetes cluster consists of at least one cluster master and multiple worker machines called nodes. These master and node machines run the Kubernetes cluster orchestration system.



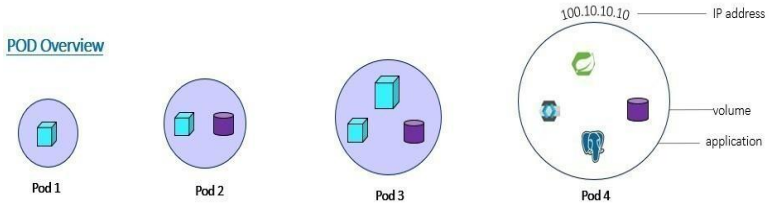
- **Nodes**

A Pod always runs on a Node. A Node is a worker machine in Kubernetes and may be either a virtual or a physical machine, depending on the cluster. Each Node is managed by the Master. A Node can have multiple pods, and the Kubernetes master automatically handles scheduling the pods across the Nodes in the cluster.



- **PODs**

Kubernetes creates Pod to host application instance. A Pod is a Kubernetes abstraction that represents a group of one or more application containers (Docker), and some shared resources for those containers.
IM-BB components shall be deployed as individual containerized application and will be grouped in multiple Nodes under kubernetes cluster.



5.2.5.5.3. Load Balancer/ Network LB

Application load balancing shall be used to distribute load among deployed IM-BB components in Kubernetes cluster. Every Pod in a cluster gets its own unique cluster-wide IP address. This creates a clean, backwards-compatible model where Pods can be treated much like VMs or physical hosts from the perspectives of port allocation, naming, service discovery, load balancing & application configuration

Kubernetes networking addresses four concerns:

- Containers within a Pod use networking to communicate via loopback.
- Cluster networking provides communication between different Pods.
- The Service resource allows to expose an IM-BB application running in Pods to be reachable from outside cluster.

However, Security server setup through WireGuard will use network Loadbalancer. Network Loadbalancer will be facilitated by Network BB team. IM-BB team will support w.r.t. documentation and configuration of setting up of security server across cloud/on-premises infrastructures.

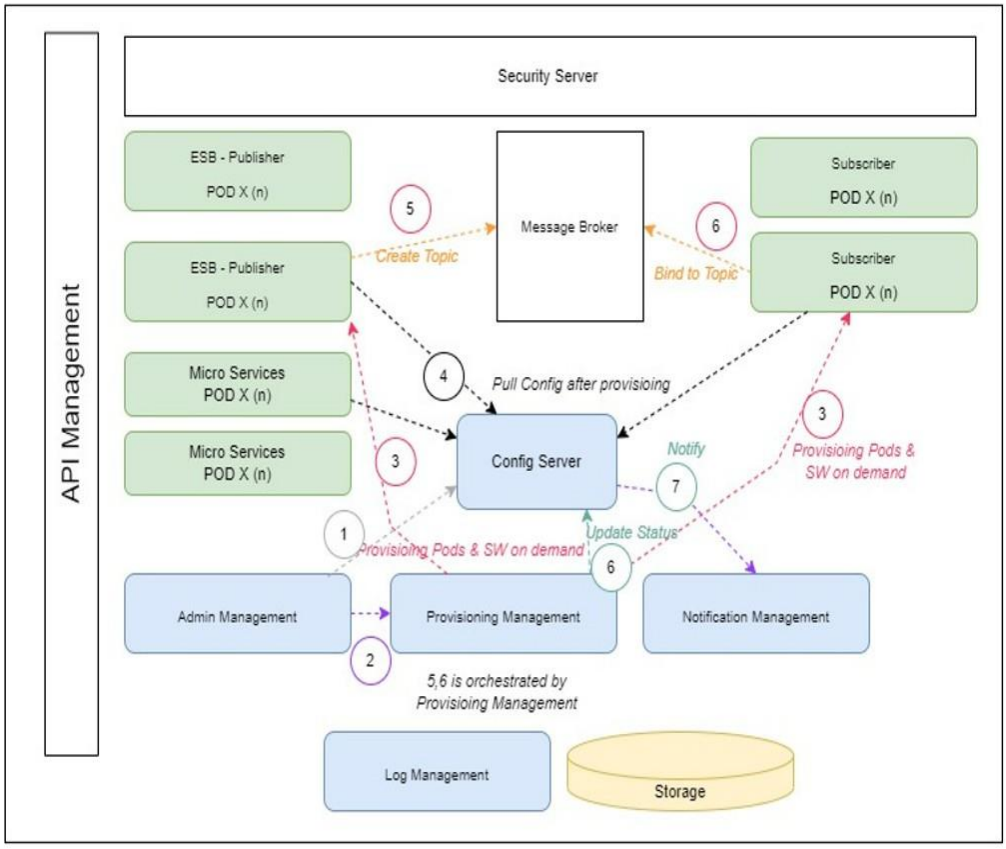
5.2.5.6. Enabler Modules

The proposed message processing pipeline is supported by modules which will bring a quality of service to the deployed pipeline. These are namely

- ✓ **Config Management:** The idea behind this module is to store all the config related data that the deployed module can pull when required. The proposed module will be backed by zookeeper. In our case all the configuration pertaining to Room Management, User Management and Service Management will be done via this module.

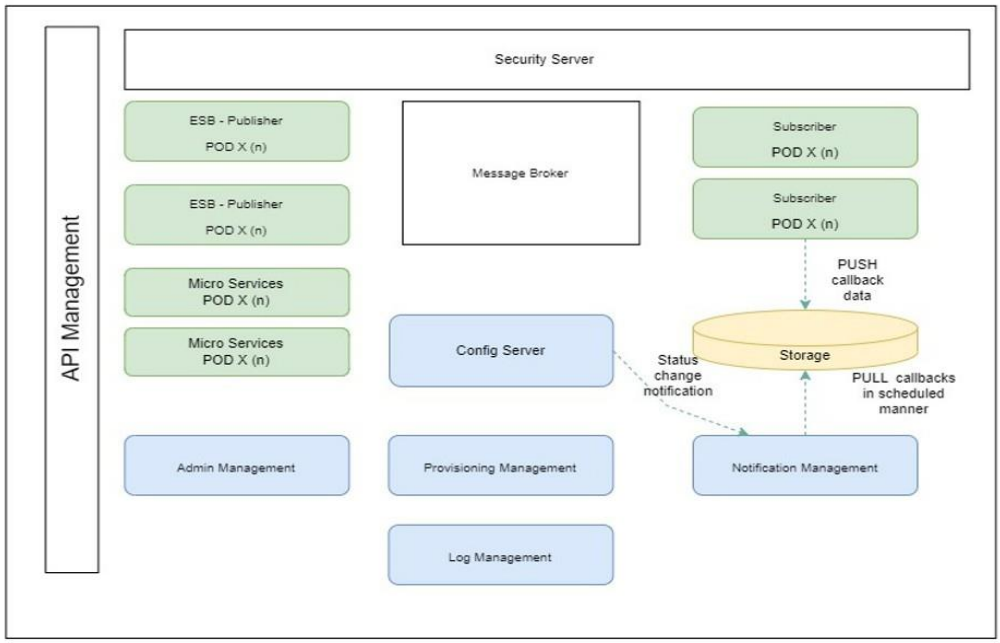
- ✓ **Security Management:** The security management will be responsible for identity and access management. The proposed module will be backed by Security Server.

- ✓ **Provision Management:** The provisioning of entire messaging pipelines would be done via this module. The module will be developed using AKKA and scripts. The module will manage the life cycle of the deployed pipelines. In the present context each pipeline area a part of the configured "ROOM". Below diagram depicts a sample provisioning of a pipeline



Picture 9 –Provisioning Management

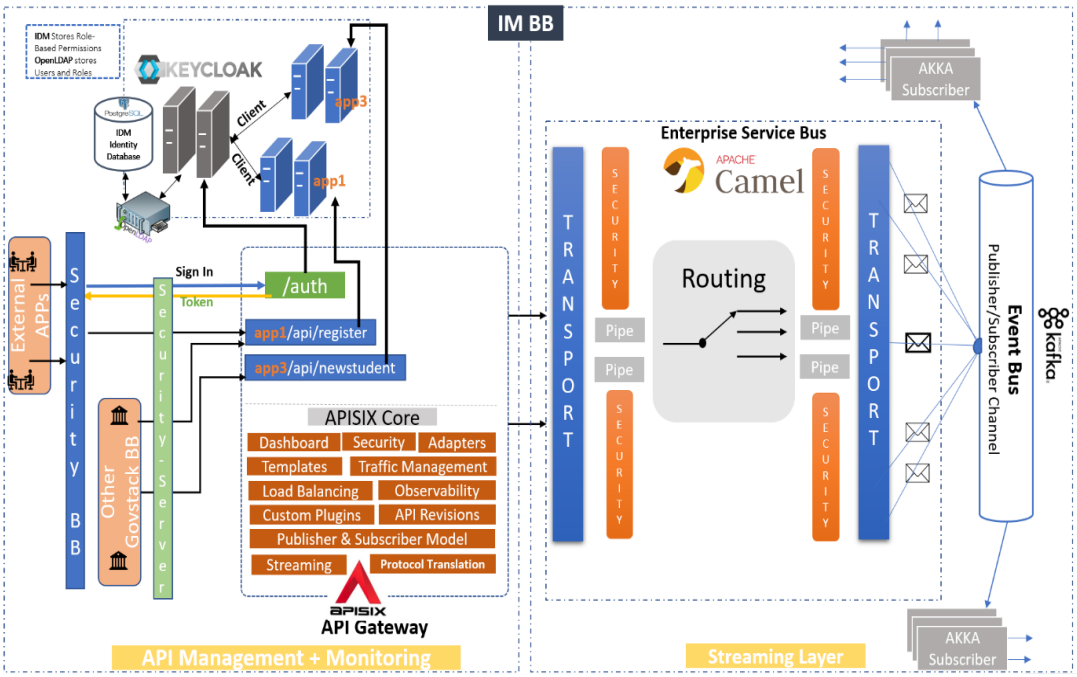
- ✓ **Notification Management:** This module is responsible for notifying internal and external modules of the changes in the state of the system. The module will also relay notifications call-backs configured in the system. Notification Management is backed by scheduler which will pull all the registered call-backs with data and notify the registered endpoints.



Picture 10 – Notification Management

5.2.6. Integration Architecture

IM-BB is the mediating block between external apps or other GovStack with legacy applications. Though IM-BB holistically acts as the integrating piece, but it uses two modules to enable security in communication. SecurityBB is used to interface IM-BB with external applications and Security Server which is an integral part of IM-BB will interface with GovStack. Security Server will use Keycloak to authenticate and authorise services exposed via API Gateway.



Picture 11 – Integration Architecture

The proposed API Gateway **(Apache APISIX)** simply means, to interact with external application and Gov-Stack building blocks (BB) for interoperability of data with various features, as discussed in above sections.

There is multilevel authentication involved while exchanging the data with other GovStack applications at the level of API gateway. Initially, the external application request would be validated by security channel at building block level. Post this the same request forwarded to API gateway where API gateway core functions perform their action and whether the same package is available or not. Re-validate the request with their headers like Rate-limiting, subscription model, CORS configuration, method request based on API versions. In parallel, gateway do the respective operations load balancing, protocol transformation, data monitoring, traffic management, dashboard, analytics etc for managing the complete IM-BB eco-system.

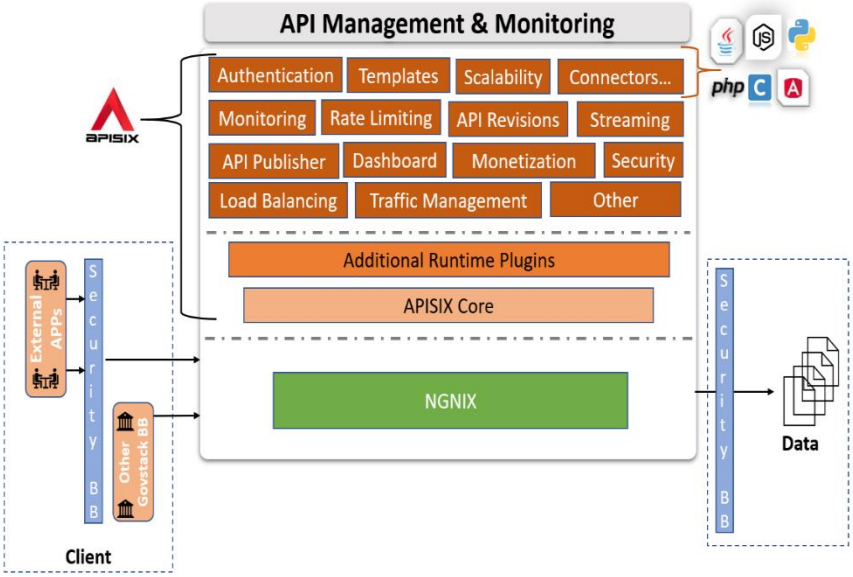
Based on the custom roles and groups of IM-BB and other GovStack application, proposing the Keycloak as IDM who manages the role-based access management for external applications and GovStack data exchanging process. Keycloak works in between API gateway and IM-BB applications. Initially, the initiated request would be authenticated at security layer of building blocks for external application then only they will be allowed to access the gateway layer while the other GovStacks application directly lands on gateway and authenticate themselves for further communications.

For exchanging data on repeated calls, the IDM/IAM manages the roles and access management between IM-BB and other GovStack or external applications. Keycloak uses the LDAP federated provider to federate the application access to Keycloak from a directory system or Active Directory.

5.2.6.1. API Management

The API Management for IM-BB or information mediator building block modules to interact and exchanging of data with other GovStack application or external apps. As per the OpenAPI 3.0 standards, data interoperability would be achieved and access the GovStack application services by API gateway.

Here in this integration approach of IM-BB, the gateway works as first channel for allowing the requests from other GovStack applications to the access IM-BB. In this integration, the proposed gateway stack is Apache APISIX. The other GovStack BB interacts with gateway security channel to connect the applications and local member instances, while external application interacts with security layer of BB post authenticating here, external application connects to IM-BB.



Picture 12 – API Management

Key characteristics of API Lifecycle Management described below -

- **APIs** interacts and exchange the data between devices, data, application, and services. Each time these services or data flow would be processed by APIs between IM-BB.

- **Dashboard**: The IM-BB API management tracks the API traffic and their dashboard for their other GovStack BB and external applications.

- **Subscription:** The GovStack BB or external application would be subscribed at gateway level and allowed to access the data based on their subscription. Based on the subscription options, IM-BB blocks the call request per day.

- **Security:** The API gateway follows various time-based authorization mechanism to validate the request. The request would be validated based on Oauth2.0 or Bearer token for the initiating event.

- **Custom Plugins:** IM-BB and GovStack application can connect the multiple application without any dependency and do some basic operations based on gateway level.

- **Loggers:** During the interaction or data interoperability b/w IM-BB and other GovStack applications, gateway supports the custom logging. Admin can use the file-logger plug-in to append JSON-formatted request and response data to log files or push the Log data stream to a specified location.

- **Rate-limiting:** There is technique to control the rate by which an API or event is exchanging the data between IM-BB and GovStack or external applications.

- **Multiplatform support:** API Gateway deployment supports bare-metal machines to Kubernetes solution. It also supports the integration with Cloud services like AWS, Azure, etc.

- **Custom Connectors:** In IM-BB integration, the building blocks can easily interact and process the data without any limitations as gateway support diversified connectors for various technologies and platforms.

- **Monetization:** It's the process by which IM-BB application generates the revenues from their exposed APIs. To provide necessary information or additional information or advertisement on new services launched to other GovStack applications.

- **Load Balancing & Routing:** In case IM-BB handling multiple incoming requests and getting the bulk requests from their multiple GovStack applications which are increasing the traffic. Gateway handles such situation by creating multiple services and calling them in **Round-Robin.** It can manage the routing of other GovStack application to IM-BB.

- **API-Versions:** The API gateway support the application-level versioning to track the onboarded applications with IM-BB or other GovStack application products. Gateway disable the older version of API and enable the latest version of API or vice-versa.

- **Reverse Proxy and caching:** To serve the static files, response, or mock data by IM-BB application is not a good idea. Gateway can hold the static data and directly serve to other GovStack applications. Similarly, the common data would be trending hourly, weekly, or monthly between applications, these trends are being calculated and IM-BB return the same response repeatedly thru gateway. In this case, an API gateway has a feature called **response cache,** where IM-BB applications mention a URL and threshold time for which it needs to cache the responses.

5.2.7. Deployment Architecture

Deployment architecture is the backbone for any web application. Proposed solution would be cloud ready solution and can be deployed on premises or any cloud environment. Solution can also be deployed on container-based deployment architecture, final decision would be taken based load requirement of the solution.

Designing API in microservices and adding horizontal scaling might seem like the best choice, unless web application is already running in an on-premises environment and need to quickly scale it because of unexpected large spikes in traffic.

This way one can scale to achieve greater efficiency with less cost. If workload is deployed in the cloud, one can use one of the available out-of-the-box options.

In more details on the proposed auto-scalable solution and dig out more, few base line parameter considerations would be:

- How many read/write requests are received per second? Per minute?
- What is the level of security required?
- Are these synchronous or asynchronous requests?

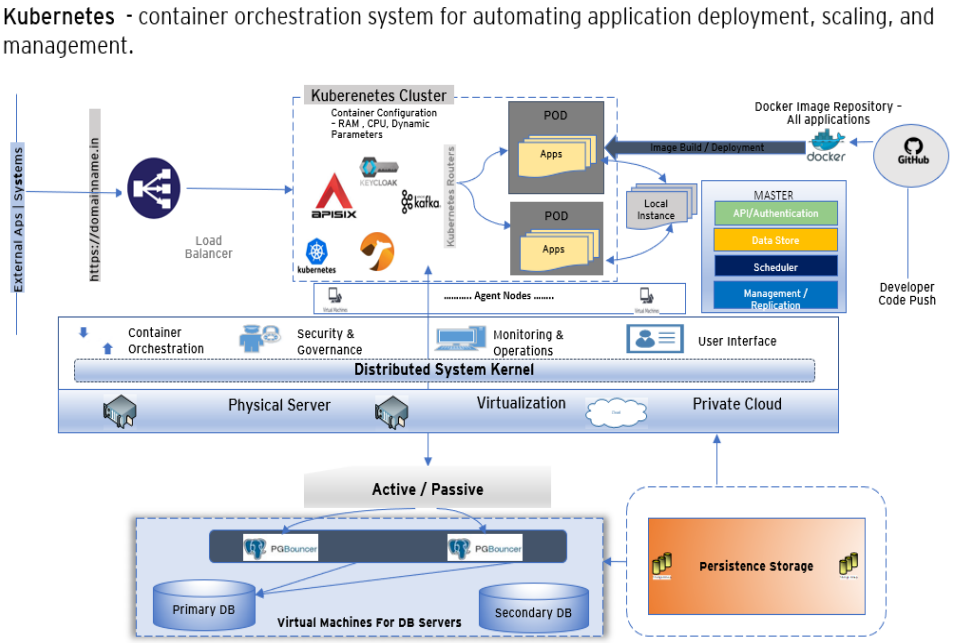
It requires few steps; it is recommended to use one at a time.

- **Reduce read load by adding more read replicas**
  To be able to serve traffic we read data from the microservices replicas. To scale our traffic, we may add more replica servers. Reading from the master does not scale and we prefer to minimize master reads.

- **Reduce write requests**
  This can be achieved by introducing queue to process the asynchronous message. Kafka is a highly scalable message broker, which can handle any kind of work-message load. Solution can process data, like transactional and data in rest; or calculate Deal Quality Score (DQS) using batch processing via topics. Auto Scaling to automatically increase or decrease the number of containers, using the number of Kafka topics, as the trigger.

- **Scale Server (Infrastructure)**
  By following approaches, it's time to scale servers based on volume of traffic on application. For the greatest cost-effectiveness and unlimited scalability, EY recommends horizontal scaling. However, use cases like database vertical scaling choice recommended with sharding approaches. It will be wise to use Auto Scaling to manage workload effectively for horizontal scaling.
  If servers hosting will be on premises, considered creating a multisite architecture, which will help to achieve quick scalability as required and provide a good disaster recovery solution.

Proposed solution recommends, platform as code capabilities along with deployment on kubernetes services (The below diagram covers auto-scalability on cloud native platform and apps will be bundled in docker images and shall be rolled out as container.



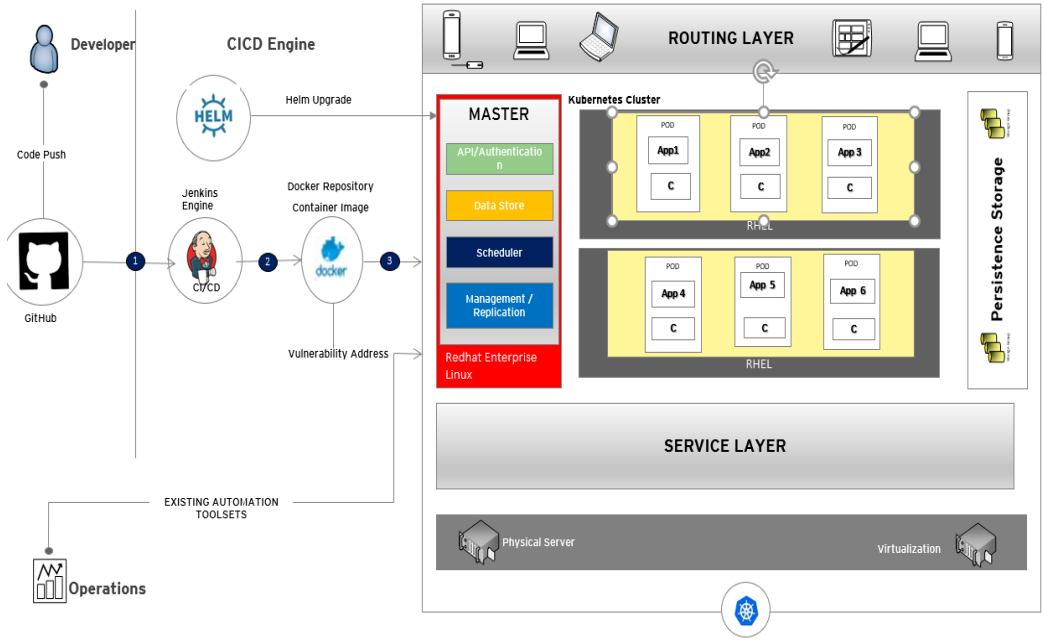
Picture 13 – Deployment Architecture

5.2.7.1. DevSecOps Automation

DevSecOps is a secure software development paradigm, given that the business requirements for IM-BB components have the potential to constantly evolve, DevSecOps would be a more suitable software development method for ITU to adopt. It also gels very well with the microservices based architectural approach and helps automate software integration, testing, deployment, and infrastructure changes to a great extent thus saving significant amounts of time and cost.

The open design philosophy behind the proposed platform and the accompanying strategic application enables a radically different and completely flexible approach to configuration and customization of application, a "build for change" philosophy. The proposed solution for IM-BB does require domain specific coding and IT/developer expertise to personalize and deploy the microservices solution for enterprise. Rule-authoring, application development and integration tools reside in microservices environment so that new applications can be developed, tested, and deployed by specific set small development team using fit-for-purpose microservices coding principles. The role of IT with regards to application development is to define the object model and integration rules to interface with external systems.

Below Image depicts IM BB platform's container deployment leveraging through DevSecOps engine using various tools and technology components. DevSecOps pipeline representation for a microservices



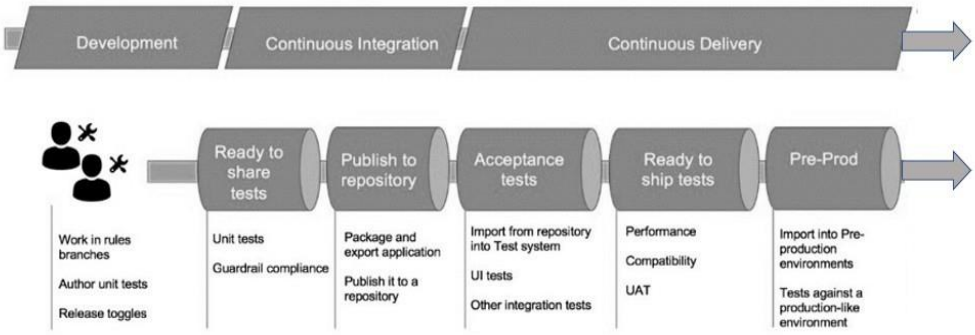
Picture 14 - DevSecOps

Proposed solution's DevSecOps offers Continuous Integration and Rapid Deployment techniques, used in conjunction of agile development methodologies, can significantly accelerate development, testing and roll out timelines for the IM-BB solution components. Adoption of technologies like Rancher along with Docker can enable infrastructure and container orchestration and scheduling. Considering that the ITU landscape has a wide variety of technologies, leveraging application catalogue templates can make it significantly easy to deploy and administer complex stacks. An illustrative devops driven characteristics for the IM-BB solution is outlined below.

- **Continuous Innovation through DevOps**

  Businesses thrive on rapid application development and delivery, and effortless updates. Proposed platform includes tools to support DevSecOps, keeps an open platform, provides hooks and services based on standards, and supports most popular tools to create a continuous integration/continuous

delivery pipeline and automated processes to quickly move applications from development through testing to deployment.
For application development, microservices architecture principles of domain driven design shall be considered and followed of agile development practices, automated testing and deployment, and continuous application monitoring. Application release management helps IM-BB application changes throughout the application development life cycle, from development to deployment on various pre-production and production environments. Furthermore, In the event of any issues, deployment can be rolled back and restore system to a previous working state.



Containers – based architecture is the go-to standard when it comes to deploying immutable, elastic micro-services. Adoptions of containers made devops landscape for microservices deployment lot easier than doing the same with virtual machines.

Microservices fundamental principles helped **containers to prevail** for the below reasons:

- **Technology shift:** Industry shifted from building server-based application on a heavy application server to stateless, immutable, scalable microservices.
- **Use & Throw:** Agility in development requires speed to deploy, test & destroy. Containers are exactly enabling that & easy to bring up & destroy.
- **DevOps:** Powerful tool to simplify the DevOps for microservices is containerization.

✓ **Agility**

Based on EY's experience of developing and delivering similar systems, agile software development when used in conjunction with DevSecOps and Microservices architecture principles can deliver software systems rapidly. Agile development focuses on clustering together groups of software requirements which can be accomplished in short sprint cycles (often 2-4-week cycles) and helps deliver robust software to end users rapidly.

✓ **DevOps tool chain constitute**

A DevOps toolchain for IM-BB is a collection of all the tools team will be using to aid in the delivery, development, and management of software applications throughout the systems development life cycle, as coordinated by ITU as organization that uses DevOps practices.

DevOps toolchains helps to create automated process to replace a lot of manual work for the teams & caters for faster rollout also helps in TTM strategy. The results speak for themselves with out of the box functionalities such as.

- **Code** – code development and review, source code management tools, code merging
- **Build** – continuous integration tools, build status
- **Test** – continuous testing tools that provide feedback on business risks
- **Package** – artifacts repository, application pre-deployment
- **Release** – change management, release approvals, release automation

- **Configure** – infrastructure configuration and management, Infrastructure as Code tools like Terraform
- **Monitor** – applications performance monitoring, end-user experience

5.2.8. Security Architecture

Through IM-BB solution the GovStack BB shall communicate through security strategies that will enhance its reach and communication. However, maintaining security of data and privacy is of paramount importance.

Proposed IM-BB Platform offers security at multiple levels while interacting with other Building Blocks and legacy systems. The security service shall also ensure authenticated access to services at various levels by managing their access rights and privileges in the system. Privileges shall also be assigned dynamically based on data elements that the user is accessing.

Further sub-sections described security implementations at various levels.

5.2.8.1. WireGuard Security Server

To achieve point-to-point security, WireGuard as technology solution has been proposed. WireGuard is an extremely simple yet fast and modern VPN that utilizes state-of-the-art cryptography. WireGuard is designed as a point-to-point VPN for running on embedded interfaces, fit for IM-BB's federated architecture.

WireGuard securely encapsulates IP packets over UDP. IM-BBs would add a WireGuard interface, configure it with private key and peer IM-BBs' public keys, and then systems can send packets across it. In contrast, it more mimics the model of SSH and Mosh; integrated IM-BBs will have each other's public keys, and then they're simply able to begin exchanging packets through the interface.

Key Features are as follows –

- Cryptographically Sound
- Minimal Attack Surface
- High Performance
- Simple Network Interface
- Cryptokey Routing
- Built-in Roaming
- Ready for Containers

5.2.8.2. Admin Interface for Security Server Management

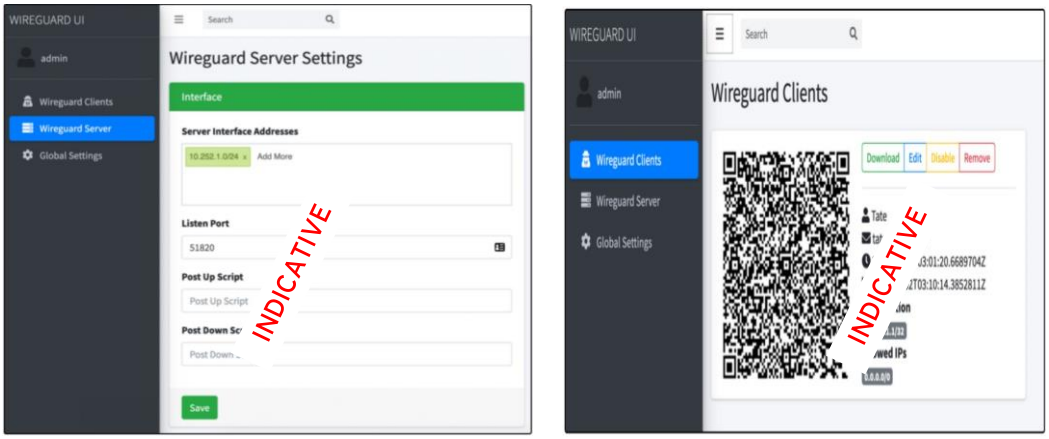
Although some of the configuration for WireGuard IM-BB security server has to take place on the command-line, the ongoing administration, some of the setup and client configuration can be abstracted away through web UI. Admin UI will be managing WireGuard servers and establishing new connections to existing WireGuard peers.

WireGuard admin interface primarily focuses on –

- Security Server Member Registration
- Security Server Workflows
- Addition / Deletion of security server client
- Access Controls

Security Server Admin interface provides flexibility and control over the actual underlying WireGuard server. This interface will be built for managing the WireGuard hub itself and the client configurations.

The interface will provision support for custom scripts, tweak server endpoint settings and manage clients all from one centralized dashboard. admin-ui will consist of peer management and adds a few more details like an email address, timestamps, and the ability to disable clients.



Picture 15 – Security Server Interface

Furthermore, administrative interface will facilitate workflow management for access control approval/rejection, revoke of rights and more.

5.2.8.3. Application Security

Also, Common Application Security will be achieved through access control and secure socket layer. Access control will be derived through authentication and authorization processes. Entity Identity will be managed by the Identity server. This layer deals with the three important aspects of the application security.

- ✓ **Audit Trail & Exception**

  Audit trail, Logger and Exception handling are the cross-cutting concern of the different components and will be managed uniformly and common module. API will be developed and modelled in such a way, as they are accessible cross the layers and single source will be responsible to manage the common functionality.

- ✓ **Secure Communication/Data Security/Audit Trail/Logging**

  All the data transmission will take place through the HTTPS protocol. All the sensitive data like confidential reports, credentials will be kept in encrypted form and any change to the information will be logged on to the system along with the timestamp and date. Transaction logs will be created against each transaction of information/data.

- ✓ **Authentication/Authorization Layer**

  Access to API, Event, Messages, and Internal Users are authenticated against user management module. Customers access the application services from the Internet or intranet, and are authenticated against this layer, using Basic Form based authentication. Role based access would be used to control the accessibility of the information/service.

  Every access to the API/Events would be managed by identity service and APIs will only be accessible once right credentials processed with the request and have to be authenticated valid token into the Identity server.

- ✓ **Exception Handling /Logging Handling:**

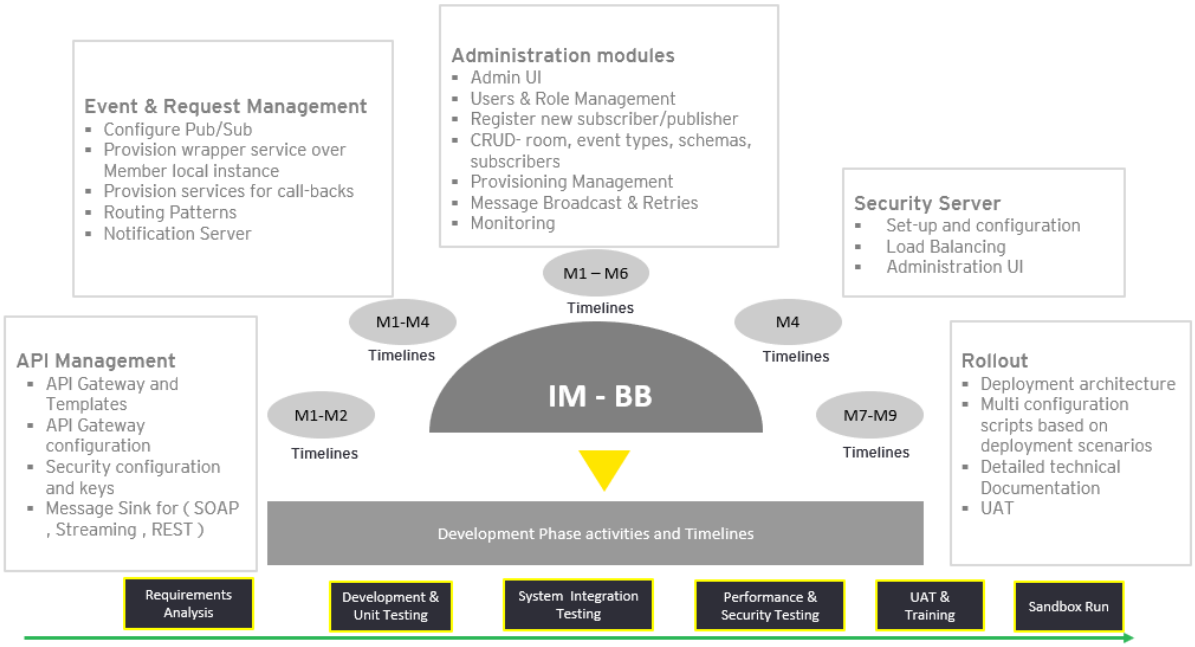
  Common Error handling will be used across the different component of the application so that common intuitive messages should be processed with response in-case of failure. Following are the coding standard to handle exception while coding web services implementation classes -

  - Always wrap potentially error-prone code within the error handler blocks
  - Always derive custom exception classes from the APIs/Applications.
  - Always suffix defined error code and custom messages with exception

- In most cases, use the predefined exception types. New exception types should be introduced only for programmatic scenarios.

5.3. Project implementation and resource deployment plans based on an agile methodology

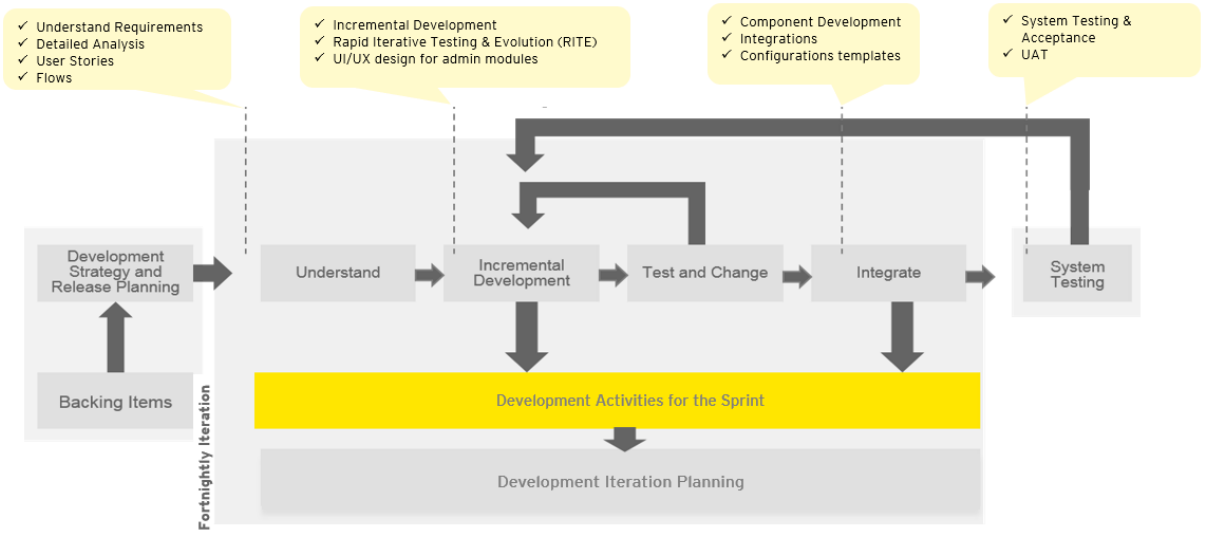
EY leverages a proven global service delivery approach to Identify, Diagnose, Design, Deliver and Sustain process improvement. It is defined by five stages consisting of Identify, Diagnose, Design, Deliver and Sustain (IDDDS) focusing on Strategy, People, Technology and Processes. The Methodology framework is supported with Project Management, Quality Assurance, Change Management and Release Management. As per the IDDDS methodology stated above, the initial phases of Identify and Diagnose would be delivered considering the holistic requirements and long-term vision with respect to application design and architecture. The subsequent phases of low-level design and development would be done using the agile approach where staged deliveries would be done considering user priority of the requirements. This methodology would ensure a phased and seamless transition over to new application while addressing the user priorities on time. The IDDDS service delivery approach breaks engagements into five phases. Each phase is broken into stages & activities, with enablers aligned to assist with accelerated delivery.



Picture 16 – Approach & Methodology

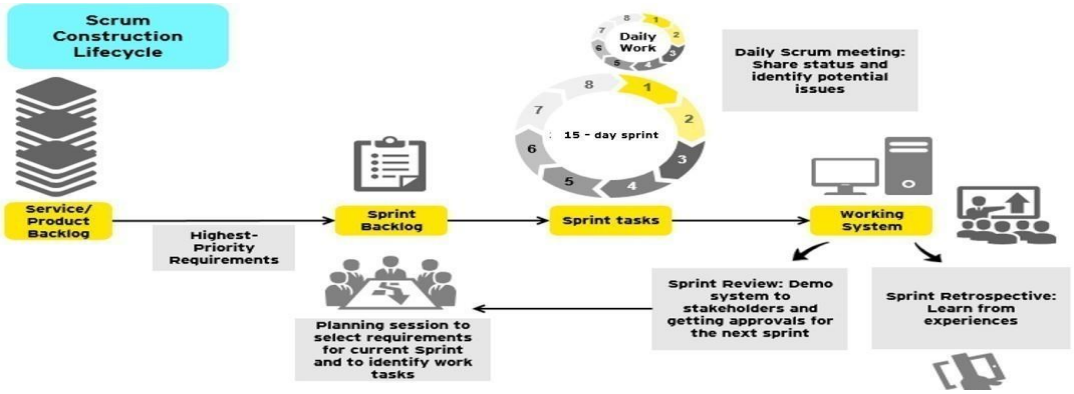
We propose to use agile methodology of application design and development as it allows for adaptive planning, component-wise development, and delivery with iterations as per the changing processes. This method allows for flexible approach to change:

- Agile Operating (AOM) framework provides a set of design dimensions relevant for Agile development
- These various dimensions address the complexity and ensure the completeness when pursuing a transformation towards Agile development
- It provides the delivery method for executing agile development across the enterprise



5.3.1. Agile Approach for Project Implementation

EY will provide a full-service play model including product implementation services. EY proposes agile methodology for the staged implementation. The model EY proposes is a hybrid model where the overall methodology is agile and for each phase, we follow the waterfall mode.



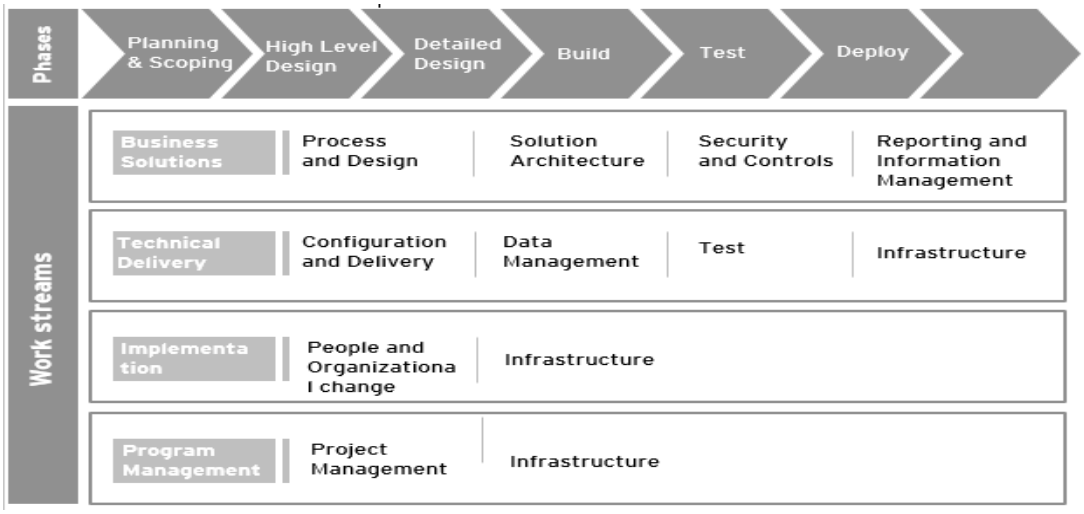
Picture 17 – Agile Methodology

We propose various stages of implementations to rollout IM-BB platform.

- Business functionality development
- Core platform is setup and component hosting
- Sandbox-based rollout of API and Integration touchpoints
- Onboarding of department to integrate with IM-BB
- Integration with any other third-party components
- Platform support and maintenance of core platform also supports to various departments for new applications integration.

Our methodology is structured in various phases that are closely aligned with the layout of widely used methodology. The phases are, in order of execution: Planning and Scoping, High-Level Design, Detailed Design, Build, Test, Deploy and Support.

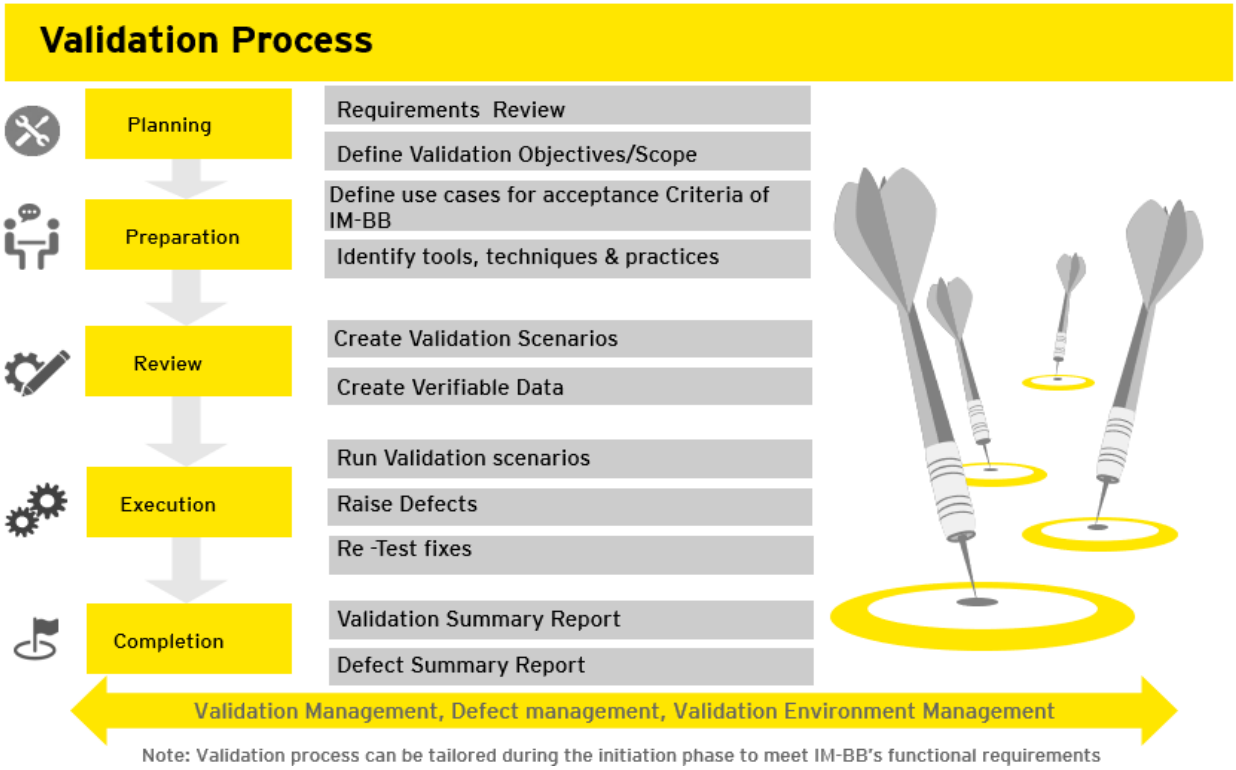
It is this integration that gives Ernst & Young a competitive advantage over other firms when it comes to these types of projects.



5.3.2. Approach for Validation

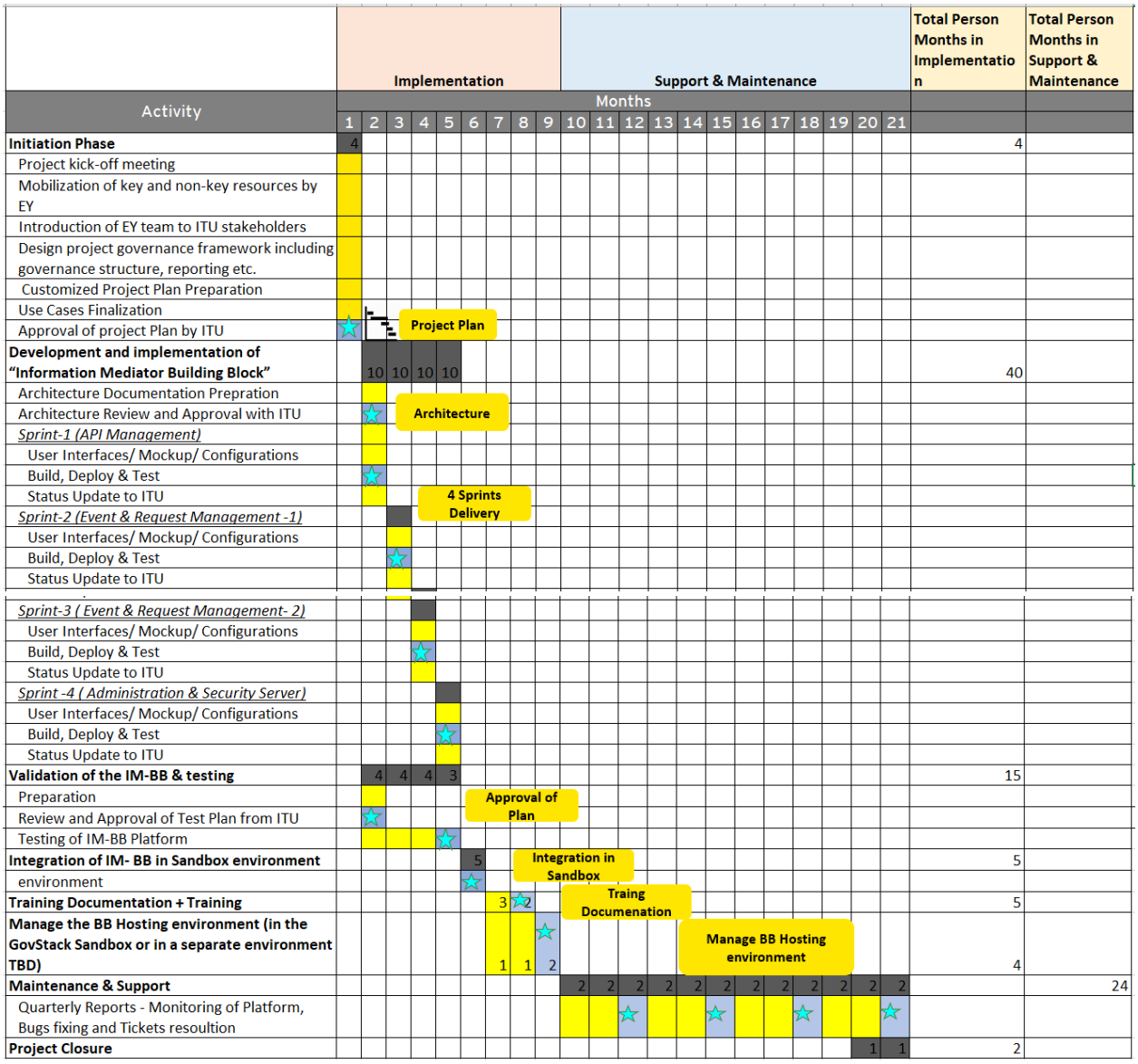
EY will draw upon its vast experience in rolling out critical systems in rapid phases with a strict adherence to quality assurance process. EY follows a standard testing life cycle which spans from unit testing to system validations to ensure qualitative application outcomes. In parallel, application security testing would be carried out to ascertain security and performance of the system; Our approach for IM-BB functional validation is not limited to the test stages in a rollout phase. We understand that validation activities should begin with the 'Planning & Scoping' stage itself. The validation scope is comprehensive and would cover both the application and deployment aspects of the IM-BB. Our approach is based on four key stages that would apply to each of the testing iterations in a rollout phase:

- Planning
- Preparation
- Execution
- Review



Picture 18 – Validation Lifecycle

5.3.3. Resource Deployment



5.3.4. Team Structure

Below figure provides key team members who would be involved as part of engagement & project oversight:

No.	Name	Qualification	Experience	Brief Experience
1.	Dominique Perron	► Fédéral Diploma in Accounting and Swiss Certified Public Accountant	30+ Years	Dominique is the EY Switzerland partner based in Geneva who is responsible for Leading for International Development for Europe Middle East India and Africa Global Consulting Partner for EY Europe West. Dominique has served non-profit and public organizations since 2005, he has a broad experience of working together with NGOs and the United Nations. Additionally, he has 30 years of experience in Switzerland, UK and Australia in Consulting, including governance, internal control, risk management and internal audit, solution implementation, assessment and optimization of Internal Control and Risk Management Systems, as well as on global innovative services leveraging robotics and crowdsourcing. Dominique is also the chairman of a large foundation helping people excluded (mainly due to handicaps) from the traditional economy to be integrated into society. He speaks French (native) and English (fluent).
2.	Axel Timm	► Lic. oec. publ. Wirtschaftsinformatk ► Executive Master of Corporate Finance ► CGEIT ► Hermes ►	30+ Years	Axel is the EY Switzerland partner leading Technology Transformation for Government & Public including the UN ecosystem. He is based in Zürich and Bern. He has an extensive experienced in setting up, implementing and running large Transformation Programs, defining, aligning specific and actionable IT Strategies, incl. M&A Transactions; ERP Suits evaluation and Implementations etc. Among Axel's most significant experiences before joining EY was the management of a Business IT Department of one of the largest IT Divisions in Switzerland. He has also helped defining and implementing a Project Portfolio Management Suite including Resource-, Skills-, Project-, Finance-and Risk-Management (over 500 Projects with 420Mio of Value). Axel is native in German, additional English and French

No.	Name	Qualification	Experience	Brief Experience
3.	Milan Narendra	▸ PGDBM (IT & Marketing) ▸ B.E (Mechanical)	20+ Years	Milan is Partner with EY India and leading IT enablement and Health practice and has more than 20 years of experience in IT sector. During his 20 years of overall experience, he has led many national and international assignment in various countries like Bangladesh, Cambodia, Middle East, Caribbean region and Afghanistan etc. He also led national level IT Enablement for projects like UNDP ICT/ERP implementation, Unified Mobile Application for New-age Governance (UMANG), Ayushman Bharat Digital Mission- India's national level health information exchange ecosystem, Social Protection System for the Royal Government of Cambodia, e-Pragati, Ease of doing business and Single Window System for Jharkhand, Uttarakhand, Chhattisgarh etc. He is experienced in Institutional design, formulation of policies and documentation, technology architecture, bid management and project management. Solution Design and Application Architecture Design of IT based solutions for large volume transaction and Develop a Framework. Monitoring and Evaluation of the proposed results by undertaking a baseline study and conceptualizing the end state outcomes for Targeted Public Distribution System, DoF&PD
4.	Parankusha S	▸ MBA ▸ M.Com ▸ B. Com ▸ ADCA ▸ PGDCA	15+ Years	▸ Parankusha has more than 15 years of national and international experience in Enterprise and Solution Architect in insurance, eGovernance solutions, e-commerce & Public sector. ▸ He is an expert in design of application standards and framework, Defining SOA Governance & Guideline, enumerating Integration Standards, Coding guidelines. He has extensive experience in Designing High- & Low-Level Architecture (Business, Technical, Integration and Deployment), preparation of Architecture score card of the various technologies/products for the required solution, application design, application standards, application development and delivery.

No.	Name	Qualification	Experience	Brief Experience
				▸ Architecting and Managing the solution using low code platform for Social protection system for Cambodia
5.	Sanjeev Nagpal	▸ B.E Computer Science ▸ PMP Certified ▸ ITIL foundation certificate in IT services Management ▸ Appraisal Team Member for CMMi level 5 Certification	20+ years	▸ PMP, ITIL V3 Professional with more than 24 years of experience in IT Delivery management involving software development and Testing Projects across Government involving on-site offshore deliveries with Agile and waterfall models, Key Account Management, International Pre- Sales. ▸ Experience in working in India, USA, Germany, MEA ▸ Responsible for the delivery management of all regional projects being executed in India and outside India

No.	Name	Qualification	Experience	Brief Experience
6.	Ganesh Vishwanath	▶ Bachelor of Engineering in Electronics and Telecommunications ▶ PRINCE2® Practitioner ▶ ITIL V3 foundation ▶ Appraisal Team Member for CMMi level 5 Certification	18 + Years	▶ Ganesh has Overall 18+ years of experience in IT Consulting, Enterprises Architecting, Software Development and Implementation and Infrastructure Management ▶ Experience in Strategic Program Manager, Delivery Manager and Assurance. ▶ Experience in Skill Management, LNG Supply Chain Management. Insurance, Government, Transportation and Express industries. ▶ Strong background in Operational and Decision Support systems. ▶ Transformation Specialist: steered processes transformation by reengineering existing process, streamlined the operations which resulted in significant saving in man hours and overall cost.
7.	Sanjin Ploskic	▶ Master in Business Consulting and Information Systems, SKEMA, FR ▶ Bachelor in History, University of Caen, FR	12+ years	Sanjin is a Senior Manager in the Consulting practice with over a decade of professional experience in the technology and government domain. He notably leads technology transformation engagements for major NGOs and NPOs, healthcare actors and public financial organizations (WHO, WIPO, TGF, ICRC etc.). He specializes in Tech Sustainability, IT Strategy and Governance including Roadmap definition, IT Portfolio management, Vendor Management, IT Operating Model design etc.
8.	Kaushalendra Pratap Singh	▶ Master of Computer Application ▶ Bachelor of Science	12+ years	Kaushalendra has more than 12+ Years of Experience in delivering large scale IT projects. He is currently leading the development of Single Window System for MP State in India. ▶ Help team to design system architecture and database ▶ Analyse the requirement, develop and deliver the required feature within specified time frame ▶ Automated test (Selenium) for developed feature and fix the existing test ▶ JUnit for code changes ▶ Develop the Data Migration Scripts

No.	Name	Qualification	Experience	Brief Experience
				▶ Update Confluence and Version-One
9.	Vinoo Das	▶ B.E in Electrical	21+ Years	▶ – Spearheaded 50 million US Dollars engagements from Technology and End-to-End Architecture perspective; balanced resources, demand, opportunity, ROI and risk; Slashed across the board costs and captured significant savings by structuring innovative technology strategies ▶ – Created a culture of innovation and continuous process improvement across the product development function, drove system capability and leading-edge solutions development through Integration Strategy, Solution assessment, Roadmap definition, Product selection, Application Maturity assessment & modernization, Establishing Competency Centre ▶ – Established Architecture/Design Boards & leading multi-location team of architects/solution designers/tech leads to drive consistent solution delivery meeting standards and best practices ▶ – Conceptualized and developed AI (Deep Learning) Platform, Cloud based Platform (AWS & Azure) ▶ – Experience of working in various verticals like HLS, BFSI, Telecom and CTO ▶ initiative called HOLMES as Enterprise Architect, Developer, Mentor and Evangelizer of disruptive technologies
10.	Vinay K Yadav	▶ B. Tech	12 + Years	▶ Solution design for complex enterprise ecosystem using open-source technologies ▶ Auto-scalable PaaS architecture design and implementation on Openshift, Kubernetes and Docker ▶ In-depth experience on cloud platform functions Azure Cloud (AKS) ▶ Microservice based application implementation ▶ DevOps architecture design for automated deployment on cloud solution.

No.	Name	Qualification	Experience	Brief Experience
				▶ Lead the transformation project like Bagel (Globe Telecom), e-Pragati as Architect. ▶ Managing multiple architecture areas of API Management, ESB Integration, SOA & Microservices. ▶ Selection of technology stacks to be used to solve a given business problem and to create a solution ▶ Capability building for AI & ML
11.	Shahid Shaikh	▶ Master of Science (Physics) ▶ Prince 2 Practitioner ▶ Oracle Exadata Database Machine Certified Implementation Specialist ▶ EnterpriseDB Associate DBA ▶ Oracle Certified Professional DBA ▶ Data Scientist with R Language and SAS from SimpliLearn	20+ years	▶ Handled Solution architecting, application designing and data migration. ▶ Integrated with SSDG, MSGD, AADHAR and e Authentication. ▶ Looked after payment gateway, digital signature, biometric authentication and E - Wallet. ▶ Involved in architecture design. ▶ Leading the offshore team ▶ Team received outstanding rating by client for development and SIT infrastructure setup. ▶ Handling a team of 8 DBAs having experience in range of 4 to 8 years
12.	Jatin A Varshney	▶ Bachelor of Engineering in	12+ Years	▶ He has over 12+ years of years of experience in various aspects of IT advisory service, developing application and consulting across the Government sectors, in India. He has helped Government

No.	Name	Qualification	Experience	Brief Experience
		Electronics and Communication		Organizations/Departments in automating their processes, Implementing ERP, etc. ▶ He has experience Programming, Applications Development, Business Intelligence, Maintenance and Enhancement especially on open source technology. ▶ He has more than 4 years of experience on eGov projects design and implementation. ▶ He has insightful knowledge of SDLC entailing requirement analysis, design, coding, testing, deployment and maintenance
13.	Sagar Bele	▶ M.Tech, ▶ B.Tech in IT	9 + Years	▶ More than 9s Years of Experience in Software Solutions on Open source as well as COTS products. ▶ Solution architected for applications Skill, Health, Budget and Finance Domain, ▶ Team management. Good hold on client interaction and capacity building with strong technical background. ▶ Experience in designing and development of Websites and Mobile App, Managing Social Media channels ▶ Experience in design and development of Budget system for Finance department, Government of Rajasthan, Health/Hospital Solutions
14.	Ajay Singh	▶ Bachelor of Technology	15+ years	▶ Extensive working experience with Linux server and client such as RHEL, CentOS. Debian, Ubuntu, Core OS) ▶ Strong scripting skills (Bash, Python) with Automation for day-to-day administration on all the running server. ▶ Strong hands-on in Git/Github, Maven. ▶ Strong knowledge of CI/CD Jenkins continuous integration tool setup against all environment (INT/UAT/STAGING/PROD) ▶ Implemented end to end automation through ansible for server monitoring/DDL executions. ▶ Strong hands-on in Web Servers (Apache/NGINX) and Application

No.	Name	Qualification	Experience	Brief Experience
				Servers. ▶ Administrate entire cloud infrastructure (NIC Cloud) With OS level (RHEL/ CentOS) management like Build new server, Patching, hardening and fixing vulnerability issue on 170+ server environment. ▶ Strong hands-on Experience in managing AWS/Azure cloud instance
15.	Arindam Chatterjee	▶ B.Tech in Computer Science and Engineerings	13 + years	▶ Software Consultant with over 11 years of experience on Development and Delivery of software products and services ▶ At present working for National e-Governance Division (NeGD-MeitY), in Umang project ▶ Earlier was working with a government client for a digital government project to advice, assist and integrate a Single Mobile Platform for various services for the Government of West Bengal (IT&E) ▶ 3 years working with Government and Public Sector projects with EY LLP ▶ 3 years worked with a global Investment Banking client to assist, advice and integrate their online trading order management system which helped them increase more trading transactions and transformed as a key player in wealth management services with Accenture ▶ 5 years worked with a T&H client to integrate and transform their online booking system to establish themselves as a key global player among major Global Distribution System (GDS) provider with Cognizant
16.	Jaspreet Kaur Sidhu	▶ Bachelor of Technology (Computer Science & sEngineering)	9+ Years	▶ 9+ years of experience as a UX/UI Designer ▶ Work with User Experience team to develop and refine prototypes ▶ Experienced in Workflow Analysis & Process re-engineering, Digital Transformation Rollout, Analytical Skills, Business Analysis, Problem Solving, Technical Knowledge, Technical Documents ▶ Key Clients Serviced - Ministry of Jal Shakti, AAAD - Ministry of Finance, India Electronics Week, IoTShow.in, Opensource India - EFY Group, Eleb2b.com - EFY Group, Intex Furniture Pvt Ltd, Atmantan Resorts, Websites, 61 Design Streets, Chandigarh, India ▶ Key Industries Serviced - Government and Public Sector, Designing

No.	Name	Qualification	Experience	Brief Experience
				Development, Digital Transformation, Ecommerce, Research and Developments
17.	Rajkamal Mishra	▶ M. Tech (IT-Bioinformatics)	5+ Years	▶ Senior Software Developer with over 6 years of experience on Conversational AI, image ▶ processing, machine learning, data visualization, and process automation ▶ System design and Application Development ▶ Programming Skills- NodeJS, JavaScript, Python, Java, R, SPSS, HTML, SQL, OpenCV ▶ (Python), Selenium, Dialogflow, RASA, OpenCL (Parallel Computing) ▶ Others: Statistics, data analysis, Git and GitHub, REST API, RDF databases, Firebase ▶ Database, DBpedia, sparql, data extraction from various sources (web scraping, PDF ▶ etc.), data visualization, and process automation
18.	Ankur Arora	▶ Master of Computer Applications ▶ Bachelor of Computer Applications	14+ Years	▶ Worked in different roles Project Manager, Automation Specialist, Test Analyst /Consultant , Business Analyst, Test Delivery Lead ▶ Part of team setting up Microsoft Practice and propositions we can take up to the market. ▶ Vast knowledge of design and implementation of Automation Framework ▶ Working knowledge of Data Driven Testing Framework, Keyword Driven Testing Framework , Hybrid Testing Framework , Behavior Driven Development Framework (BDD) ▶ Extensive knowledge of Testing processes, methodologies, and Test Automation tools like QTP, Silktest, Load runner, Open STA ▶ Extensive knowledge and experience of different levels of testing – System Testing (ST), SIT (System Integration Testing), User Acceptance Testing (UAT), DVT, TVT , BVT, API , Upgrade and Data Migration Testing ▶ Vast experience in Excel, developed multiple tools/utilities in Excel.

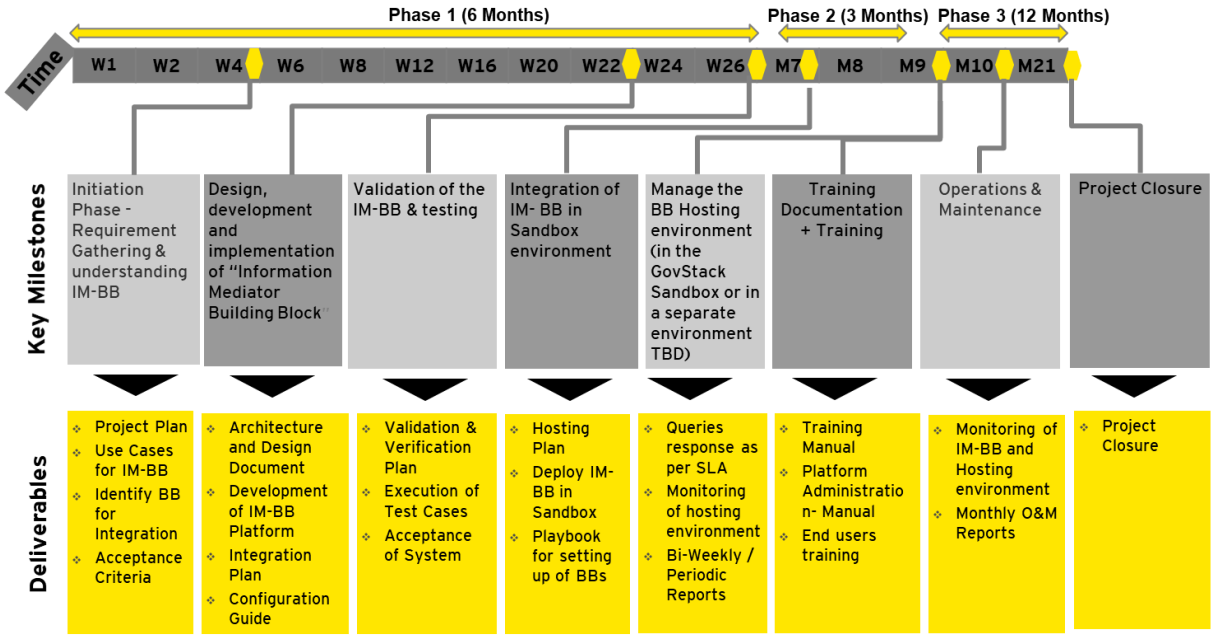
No.	Name	Qualification	Experience	Brief Experience
				▶ Strong People Management skills for Team building, mentoring ▶ Strong Project Management skills with ability to work on multiple projects ▶ Wide exposure on test methodologies – Agile, Waterfall, Scrum, DevOps ▶ Worked on various type of Metrics like Productivity, Test Effectiveness, Effort Variance, schedule Variance. ▶ Providing Test Management Services including co-ordination with client users for conducting UAT. ▶ Coordinating with Legal, Finance and Onsite Regional Managers & Partners ▶ Perform pre-sales support activities by creating/reviewing Efforts Estimates, performing QRM activities, making Presentations.
19.	Anupam Sahu	▶ Bachelor of Technology	9+ Years	▶ Senior Consultant with over 6.6 years of experience on IT Enablement Projects. ▶ Skills include Functional Testing, Automation Testing, API testing, Business Analysis, Robotic Process automation Through UI Path
20.	Sanjeev Mishra	▶ Executive MBA (Information Technology & Operation Management) ▶ MSC (Computer Science) ▶ BSC-IT (Hons)	10+ Years	▶ Total 10+ years of experience in implementing e-Governance/ICT projects in various Government departments. ▶ Worked in various capacities viz. Process advisory, Business Analyst, ICT curriculum advisory, Program management, Change management & Capacity building on various projects. ▶ Worked in Government Advisory at SPMU level & at ground implementation level in various sectors like: Health Department and Urban Local Bodies. ▶ Worked as Consultant to Government of Madhya Pradesh and provide consultancy in area of end to end automation solution, process improvement for the department of General Administration Department & Public Grievance- Redressal Department Government of Madhya Pradesh.

No.	Name	Qualification	Experience	Brief Experience
				▶ Effectively roll out the large scale DBT PFMS HM project of more than 45+ NHM Programme at 200 PHCs in state of Bihar.

5.4. Proposed time schedule for all the activities and deliverables.

EY has proposed 3 Phase approach for overall delivery of IM-BB.

- Phase -1 would span over 6 months and cover Initiation, Design, Development & Validation of IM-BB platform
- Phase -2 would span over 3 months and cover Integration of IM-BB in Sandbox environment, Manage BB environment and Training documentation.
- Phase-3 would 12 months O&M & closure at the end of 12th month of this phase



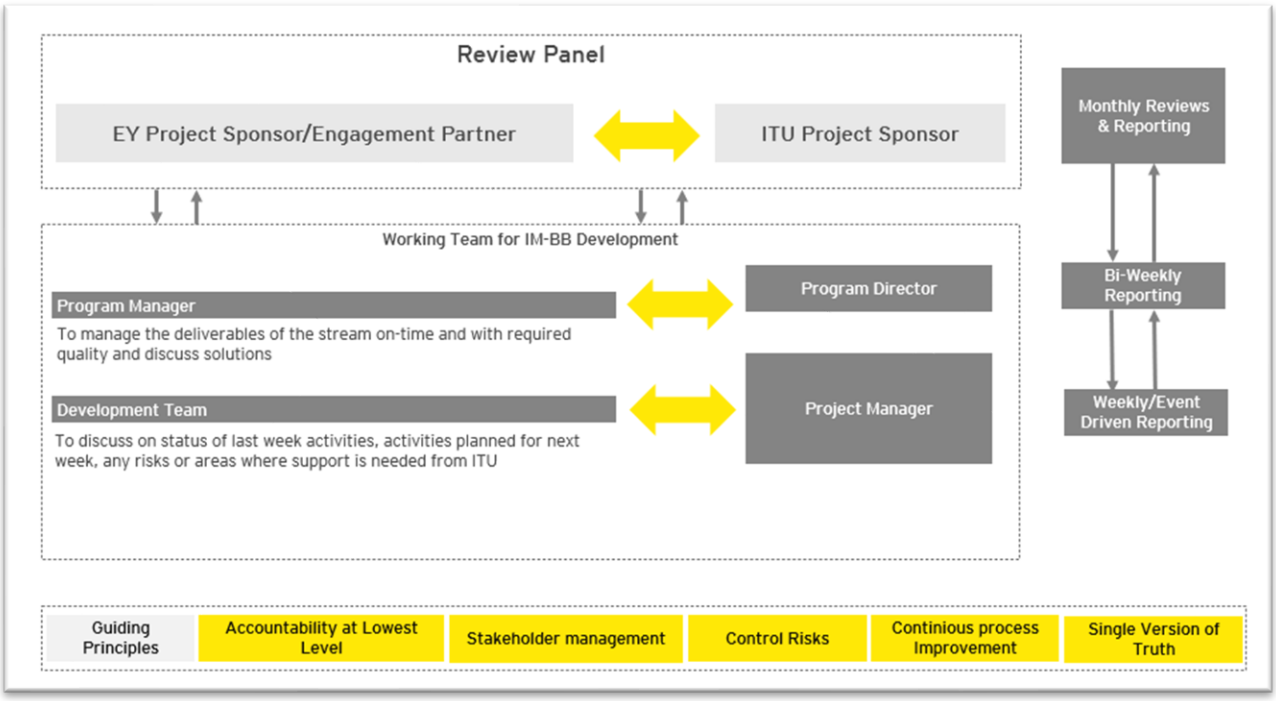
EY would be working against above proposed timelines for each of the deliverables and request ITU's support to meet these timelines:

Phase -1	Support Required from ITU
Initiation Phase -Requirement Gathering & understanding IM-BB	➢ Identify SPOC for approvals of Deliverables throughout the project ➢ Approval of Use cases for IM-BB Platform ➢ Finalization & Approval of other BB Integration ➢ Acceptance Criteria for IM-BB Platform ➢ Finalize overall Project Plan
Design, development and implementation of "Information Mediator Building Block"	➢ Integration Scenarios for identified BB in Initiation Phase
Validation of the IM-BB & testing	➢ Timely availability of team identified for platform acceptance and closure of activities in defined timeframe
Phase -2	
Integration of IM- BB in Sandbox environment	➢ Access to other BB for integration
Manage the BB Hosting environment (in the GovStack Sandbox or in a separate environment TBD)	➢ Access to Hosting environment as per project plan
Training Documentation + Training	➢ Review / Approval of Training Contents ➢ Availability of team and arranging infrastructure required for conducting training

Phase -3	
Operations & Maintenance	➢ SPOC from ITU to review & sign-off reports shared by EY
Project Closure	➢ Availability of ITU team to take over the documentation & system – At least 6 weeks before closure of project

5.5. Project management and monitoring approach for the project.

As part of the delivery of software services EY proposed to set up three distinct layers of governance. Each layer of governance will focus on a different aspect of the delivery of software services to ITU. Key metrics aligned to the strategic goals associated with the EY team will be used in each layer of governance to help drive the work and evaluative the outcomes associated to this change agenda.



The project management strategy will be based on clear structuring of the project work into phases and activities consistent with the methodology leading to appropriate deliverables as scheduled. The project management methodology will be based on the following project management activities:

- Project planning
- Project monitoring and control
- Problem reporting and escalation
- Risk management
- Change management
- Project communication

EY extensively uses Integrated Project Management System as Project Management tool together with MS-Project which is customized and standardized as per the requirements in the Quality Management System.

5.5.1. Project Planning

Project planning is a crucial element of project management and this will be taken up as the very first activity in this project. Project planning will involve the following activities:

- Project Development Plan (PDP), which will involve activities like Sizing, Effort estimation, Staffing and Scheduling
- Quality Assurance (QA) Plan which will involve activities like defining criteria for success, constraints and Quality checks on product, metrics adopted etc
- Configuration Management Plan (CMP), which will involve fixing of base line, directory structure, backup mechanisms, etc.

The project plan will include:

- The major activity streams during the next stage like analysis and design.
- List of activities and sub-activities for each activity stream, the persons responsible and the resource requirements for the activities.
- Location of each group of activities, and the communication mechanism between the locations.
- Schedule of activities for monitoring and control.
- Project reporting formats and contents.

5.5.2. Project Monitoring and Control

The project management activities described in this section covers project monitoring and control functions. All project monitoring will be done against the project plan prepared initially and refined with the progress of the project. The project manager will monitor the progress of the activities against the plan and will prepare periodic project status reports. The project report will be used for discussion in the Project Status meetings.
Status reports will be maintained for continuous improvement purposes. Contents of such reports typically shall include the following:

- Completed activities
- Activities yet in-progress as against the project plan
- Unplanned activities
- Risks
- Changes in the project
- Support Required from ITU

5.5.3. Problem Reporting and Escalation

All outstanding issues will be reported in the status reports. These will be discussed at the weekly status meetings. If any critical issue is not resolved in two meetings, the issue will be escalated up to the next level and thereafter to the higher management chain to ensure quick resolution.

5.5.4. Configuration Management and Version Control

EY recognizes software configuration management as one of the most crucial aspects of Project Management.
EY will implement configuration management as follows:

- By maintaining and recording baselines for data, products and documents that are released/received from ITU.

- By controlling any changes to baseline items through Change Control Procedures.
- By using change requests to trace the software items affected by the change

The development environment will form an integral part of the configuration management. Status of various configuration items will be maintained.

5.6. Operations & Maintenance Plan

As per RFP requirement, EY will provide 1 year of Operations & Maintenance support & it would consist of following stages

- Post Implementation & Technical Support
- Technical Support
- Quality and Risk Assessment
- Change Request Management
- Knowledge Transfer and Exit Management

5.6.1. Post Implementation & Technical Support

Post Implementation Support /Operations & Maintenance phase will start after completion & hosting on IM-BB. O&M support would be provided on 8 hours on working days basis, however for critical bugs, support would be provided as per SLA requirement. Overall support methodology will consist of followings:

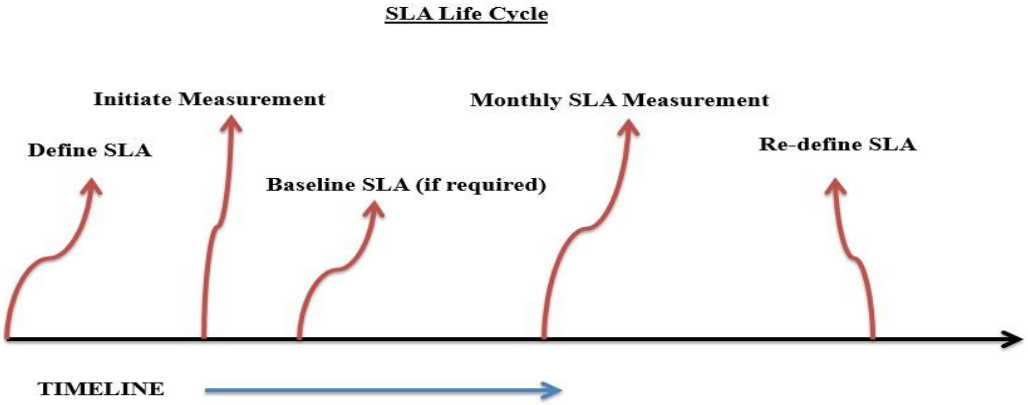
- Analysis and resolution based on Priorities and Severity of defects within defined SLA
- Platform and application performance monitoring
- SLA Monitoring and Reporting
- Regular maintenance: The regular maintenance will entitle Mobile Platform backend system to the following:
  - Provide L3 support for scope of work of IM-BB
  - Monitoring the production environment
  - Routine and Preventive maintenance of the environment
  - Any error/defect/bug correction as and when released by EY.
  - Impact Analysis due to any changes in operating systems, databases, hardware, and other equipment connected to the system will not be included in this support arrangement
  - API Integration and deployment for new departments will be taken by as separate change request

In the O&M phase, following reports on shall be submitted periodically to the ITU:

- Fortnightly

- Monthly
- Quarterly

As part of O&M phase, key SLA would be taken up from RFP. The SLA terms and conditions for O&M phase would be further detailed and negotiated during the initiation of O&M phase. The formulation of these SLAs would be done based on the life cycle process designed below. This would be deliberated towards the end of warranty period to capture all the SLAs.



5.6.2. Approach for Change Management Process

All activities that require change to the code, configuration or integration of IM-BB components, Supporting Integration of IM-BB for new department shall be handled through the change management process. The following activities will be executed as part of change management:

- Receipt of Change Request (Internal / Customer)
- Impact Analysis of the Change Request
- Negotiation / Decision on Change Request Implementation
- Change Implementation
- Change Tracking
- Change Version Control
- Change Release and Record Management

The business users of ITU can raise a request for a change. EY would establish change control processes to manage changes to the agreed scope and other dimensions within the Project. The process will capture all requests for change while at the same time ensuring that decisions are traceable, made at the correct level, and that their impacts are fully analysed and absorbed.

5.6.3. Risk Management Plan

EY, starting from initiation till duration of the contract, would undertake identification of key risks and prioritization for designing suitable control mechanism. A consultative approach would enable the project management team to design effective control mechanism to mitigate the risks. Risk is an important element of any project. It provides an estimate of the magnitude of the unexpected outcomes (the surprise factor) on the project. A project management methodology is not complete without a forward-looking risk management component.

Some of the main objectives of this aspect of project management are:

- Identification of high, medium and low risk areas and pain points
- Identification of Risk Mitigation Methods and implementation plans
- Risk Mitigation Plan and Execution
- Tracking, monitoring and reporting risks to previously defined authorities
- Implementation of alternate strategies at appropriate times
- Observance of all Quality aspects including documentation, process control and strict adherence to Service Level Agreements (SLAs)

Illustrative risks and risk mitigation approaches are:

Risks	Illustrative Risk Mitigation Plan
Requirements may evolve during implementation resulting scope creep & impacting project timelines	▸ Finalize the scope of work and execution plan during initiation phase ▸ Engagement model encompasses dedicated team for fixed scope of work while other team on T&M basis for taking up additional activities
User Acceptance of IM-BB System while other Building blocks / integrating systems are not in place	▸ Define use cases for specific domain during initiation phase ▸ Create simulation based on defined use cases to mimic the integration functionality ▸ Provision additional infra within the Sandbox to facilitate performance testing
Insufficient resources to manage and respond to user queries	▸ Plan for adequate support resources during roll-out ▸ On field support personnel to respond to queries
Delay in infrastructure availability	▸ Early Decision on finalization of deployment methodology of Cloud deployment will help in minimizing the delays
Change in scope during implementation	▸ ITU and EY will agree upon detailed Scope that is feasible in the given timeframe ▸ Status reports will be finalized at the project initiation stage and will be shared periodically by the EY team with ITU ▸ Project Manager. ▸ Any new requirements / changes to agreed requirements would be taken as CR. CRs would be prioritized and taken up separately
Delay in Review Feedback	▸ To agree upon the timeframe within which written feedback will be provided ▸ Acceptance criteria (as described) will help in Implementation

Risks	Illustrative Risk Mitigation Plan
	▸ Regular monitoring of the progress through the different levels of strategic / tactical management groups will help in ensuring that such delays are kept to minimum
Delay in Approvals for Departments for API Integration	▸ To ensure SPOC for departments are identified and agreed upon the timeframe of the requirements and written feedbacks provided

5.6.4. Exit Management Plan

EY understands the importance of timely transition and the process of Exit management on completion of engagement. With this, we recommend that any transition should get complete in three months' time period & should start three months before completion of the contract. EY, with its strong matured delivery process, shall ensure documentation and knowledge impart sessions to stakeholders during the entire period of project execution. Assets related to knowledge transition shall be regularly created and updated in the mentioned frequency. This will reduce the required KT duration to new partner or client. The exit management will begin with EY providing training to designation team members from ITU or ITU identified vendor to be able to use proposed solution effectively. EY shall carry out a comprehensive training needs analysis and design the training program in discussion with SPOC identified by ITU. Training will include classroom training followed by supervised work sessions. EY shall prepare all necessary training materials and deliver the training.

EY shall submit a detailed exit management plan within 60 days before completion of contract. keeping below points in consideration of ITU oversight and support during the transition to new partner of Information Mediator Building Block-

1. Ensure continuing provision of the services throughout the transfer process
2. No impact on Information Mediator Building Block operations because of undertaking the transfer
3. If required, propose recommendation on segregation of Network with identification of specific security during transition, team structure with skills/experience details that shall be responsible for the transition, time-table etc.

EY, based on its experience of previous successful transitions, believes that the following key personnel are essential for ensuring a smooth and seamless exit transition.

- Single point of contact – ITU Transition Manager to take over the roles and responsibilities from EY Delivery Manager.
- Solution/Application Lead
- Support Group staff – Helpdesk, Problem Management, Service management, change management, third party contacts and so on.
    A. EY will identify the key resources from the existing team to support the transition to ITU. These associates will have complete functional and technical understanding of the applications/platforms.

    B. Knowledge transfer and acquisition is achieved by the initial application exposure, Configuration and deployment on cloud setup exposure.

The need for Knowledge Acquisition stems from the need for:

- Sufficient time for Transition
- Application Maintenance/Conversion outsourcing
- EY will provide complete access on the document which has been prepared on the applications, systems, and so on to the incoming team. EY will also assist the incoming team in:
    - Studying and reviewing the existing documentation
    - Reviewing the existing source code, design document and understanding the application workflow
    - Reviewing the problems and enhancement that have happened in the recent past
    - EY will address all the concerns of ITU /incoming team related to the transfer of knowledge about applications and other details. Measurements will be taken at specific intervals and key metrics indicating the effectiveness of acquisition will be monitored.

C. The incoming team need to organize playback sessions (PBS) to demonstrate knowledge gained during this rapid knowledge transfer phase and to enable client to gain assurance. EY will provide feedback ratings and also recommend areas for improvement. The playback session(s) will be helpful in identifying the improvement areas, so that the subsequent knowledge transition activities can concentrate on those areas.

D. EY uses different tools and techniques to effectively transfer the gained knowledge and provide required level of training to the new team. Those techniques are:

Presentations

EY uses the technique of presentations for transfer the knowledge on applications, systems, infrastructure, environment, processes, procedures etc. to the new team.

Classroom Sessions

Classroom Session is a tool used to share the knowledge on applications, systems and processes, where EY team carries out knowledge sharing sessions with the guidance and support from client. In the Classroom Sessions, knowledge can be transferred through Presentations, and Question and Answer sessions. In case of sudden attrition of associates, the transition timelines might change. It will be the responsibility of both ITU to plan for new transition timelines which will be reviewed and approved by the Governance team.

Execute

The disentanglement methodology comprises of the following phases:

Knowledge Transfer

- The metrics which were followed during the project execution will be shared with ITU
- Knowledge sharing Sessions will be conducted by EY team on platform, process, standards, tools, policies and procedures
- Documents related to the applications will be provided
- Quizzes and play back sessions will be conducted
- Operation and application manuals will be reviewed and approved

Primary Support

In this phase the ITU/ Incoming Vendor will be primarily responsible for the delivery and support. The key activities during this phase are

- Ensure that the new team has access to all the systems and there is no dependency on EY in terms of the access
- EY will provide secondary support to the ITU but in case of Severity 1/ Severity 2 incidents, EY should step in and make sure that the incident is resolved within the SLA.
- EY will be accountable for the SLAs till the contract is valid

Verify

- EY will carry out a cross over audit for ITU as a reality check for the completeness of disentanglement
- The verification as per the acceptance criteria will be conducted.

Dismantle

- Relocation formalities will be completed for the EY associates
- Backup of the applications and the available support documentation will be created.

Artefacts Supplied during Transition and Exit

Following is the tentative list of artefacts that will be supplied to ITU /alternate vendor during exit

Area	Documents/Artefacts to be delivered during Exit Management
Software Related	▸ List of the live and operational inventory, details of software (including applications, middleware, tools, scripts etc.), associated licenses with their validity & relevant keys / credentials ▸ Procedure for configuration of core components of IM-BB ▸ Configurations changes done to core platform for Integration ▸ All Project Plans, Design documents, custom code base, Verification & Validation documents, Training Documentation ▸ Documentation to transfer administration access of all components integrated on core platform ▸ Handover of updated code, Archives/logs/reports etc.
Project Management / Development	▸ Monthly Project Management reports and Key Metrics ▸ Issue Log with Status ▸ Configuration Items listing, status and Versioning history ▸ Project Management Plans – Planned/ actual
Service Delivery Related	▸ Availability and Performance management reports with SLA compliance
Capacity Building	▸ Training Documentation
Governance/Management	▸ Lessons Learnt ▸ Best Practices

6. Comments on ITU General Conditions of Contract

We have reviewed the general conditions of the contract and summarised proposed language for some of the articles / clauses for consideration and incorporation in agreement, if possible

Article	Current Text	Proposed Language
13. Insurance and liability	13.1. The Contractor shall pay ITU promptly for all loss, destruction, or damage to the property of ITU caused by the Contractor's personnel or by any of its subcontractors or anyone else directly or indirectly employed by the Contractor or any of its subcontractors in the performance of the Contract. 13.2. Prior to commencement of performance of any other obligations under the Contract, the Contractor shall provide and thereafter maintain for the entire term of the Contract, for any extension thereof, and for a period following any termination of the Contract, insurance reasonably adequate to deal with losses, and more specifically: 13.2.1. insurance against all risks in respect of its property and any equipment used for the execution of the Contract or any good to be delivered to ITU. 13.2.2. workmen's compensation insurance, or its equivalent, or employer's liability insurance, or its equivalent, with respect to its employees sufficient to cover all claims for injury, death and disability, or any other benefits required to be paid by law, in connection with the performance of the Contract. 13.2.3. liability insurance in an adequate amount to cover any and all third-party claims, including but not limited to, claims for death or bodily injury, products and completed operations liability, or loss of or damage to property, arising from or in connection with the Contractor's performance under the Contract, including, but not limited to, liability arising out of or in connection with the acts or omissions of the Contractor, its personnel, agents, servants or sub-contractors during the performance of the Contract, of any vehicles, boats, airplanes or other transportation vehicles or other equipment, whether or not owned by the Contractor; and, 13.2.4 such other insurance as may be agreed upon in writing between ITU and the Contractor.	Contractor must maintains professional indemnity insurance. Professional indemnity insurance covers and professional liability up to an appropriate level sufficient for the purposes of this engagement. PII policy is confidential, the terms of the policy shall be disclosed if required. ITU shall not recover from the Contractor, in contract or tort, under statute or otherwise, any amount with respect to loss of profit, data or goodwill, or any other consequential, incidental, indirect, punitive or special damages in connection with claims arising out of this Agreement or otherwise relating to the Services, whether or not the likelihood of such loss or damage was contemplated. ITU shall not recover from the Contractor, in contract or tort, under statute or otherwise, aggregate damages in excess of the fees actually paid for the Services that directly caused the loss in connection with claims arising out of this Agreement or otherwise relating to the Services.

	13.3. Except for the workmen's compensation insurance, the insurance policies under this Section 13 shall: 13.3.1. name ITU as additional insured. 13.3.2. include a waiver of subrogation of the Contractor's rights to insurance carrier against ITU; and, 13.3.3. provide that ITU shall receive at least a thirty (30) calendar days written notice from the Contractor's insurance carrier prior to any cancellation or change of coverage. 13.4. The Contractor's liability policies shall also cover subcontractors and all defense costs and shall contain a standard "cross liability" clause. 13.5. The Contractor shall maintain the insurance taken out under the Contract with reputable insurers that are in good financial standing and that are acceptable to ITU. Prior to the commencement of any obligations under the Contract, the Contractor shall provide ITU with evidence, in the form of certificate of insurance or such other form as ITU may reasonably require, that demonstrates that the Contractor has taken out insurance in accordance with the requirements of the Contract. ITU reserves the right, upon written notice to the Contractor, to obtain copies of any insurance policies or insurance program descriptions required to be maintained by the Contractor under the Contract. Notwithstanding the provisions of Section 13.3, above, the Contractor shall promptly notify the ITU concerning any cancellation or material change of insurance coverage required under the Contract. 13.6. The Contractor acknowledges and agrees that neither the requirement for taking out and maintaining insurance as set forth in the Contract nor the amount of any such insurance, including, but not limited to, any deductible or retention relating thereto, shall in any way be construed as limiting the Contractor's liability arising under or relating to the Contract.	
17. Confidential nature of documents, information and other data	17.1. Documents, information and other data that is considered proprietary by either Party and that is delivered or disclosed by one Party ("Discloser") to the other Party ("Recipient") during the course of performance of the Contract, and that it designates as confidential	Contractor should ensure confidentiality for period is 3 years from the date of termination.

	("Information"), shall be held in confidence by that Party and shall be handled as follows: 17.2. The Recipient shall: 17.2.1. use the same care and discretion to avoid disclosure, publication or dissemination of the Discloser's Information as it uses with its own similar information that it does not wish to disclose, publish or disseminate; and, 17.2.2. use the Discloser's Information solely for the purposes for which it was disclosed. 17.3. Provided that the Recipient has a written agreement with the following persons or entities requiring them to treat the information confidential in accordance with the Contract and this Section 17, the Recipient may disclose Information to: 17.3.1. any other party with the Discloser's prior consent; and, 17.3.2. the Recipient's employees, officials, representatives and agents who have a need to know such information for purposes of performing obligations under the Contract, and employees, officials, representatives and agents of any legal entity that it controls, controls it, or with which it is under common control, who have a need to know such information for purposes of performing obligations under the Contract, provided that, for these purposes a controlled legal entity means: 17.3.2.1. a corporate entity which the Recipient owns or otherwise controls, whether directly or indirectly, over fifty percent (50%) of voting shares thereof; or, 17.3.2.2. any entity over which the Recipient exercises effective managerial control; or, 17.3.2.3. for ITU, a governing organ, or subsidiary organ of ITU established in accordance with the Constitution, the Convention of ITU or any decisions of the ITU Plenipotentiary Conference or of the ITU Council. 17.4. The Contractor may disclose Information to the extent required by law, provided that, subject to and without any waiver of the privileges and immunities of ITU, the Contractor will give ITU sufficient prior notice of a request for disclosure of Information in order to	

	allow ITU to have a reasonable opportunity to take protective measures or such other actions as may be appropriate before such disclosure is made. 17.5. ITU may disclose Information to the extent as required pursuant to the Constitution and Convention of ITU, the rules, decisions, resolutions, and recommendations of its governing organs, or rules promulgated by the Secretary-General. 17.6. These obligations and restrictions of confidentiality shall be effective during the term of the Contract, including any extension thereof, and, unless otherwise provided in the Contract, shall remain effective following any termination of the Contract.	
12. Indemnification	12.1. The Contractor shall indemnify, hold and save harmless, and defend, at its own expense, ITU, its officials, agents, servants and employees from and against all suits, proceedings, claims, demands, losses and liability of any nature or kind brought by a third party against ITU, including, but not limited to, all litigation costs and expenses, attorney's fees, settlement payments and damages, based on, arising out or relating to: 12.1.1. allegations or claims that the possession of or use by ITU of any patented device, any copyrighted material, or any other goods, property or services provided or licensed to ITU under the terms of the Contract, in whole or in part, constitutes an infringement of any patent, copyright, trademark, or other intellectual property right of any third party; and, 12.1.2. acts or omissions of the Contractor, or the Contractors' representatives, employees, officers, agents, servants or subcontractors, in the performance of the Contract. 12.2. The indemnity set forth in Section 12.1.1, above, shall not apply to a claim of infringement resulting from the Contractor's compliance with specific written instructions by ITU directing a change in the specifications for the goods, property, materials, equipment or supplies to be or used, or directing a manner of performance of the Contract or requiring the use of specifications not normally used by the Contractor.	This clause to be deleted

	12.3. ITU shall advise the Contractor about any such suits, proceedings, claims, demands, losses or liability within a reasonable period of time after having received actual notice thereof. The Contractor shall have sole control of the defense of any such suit, proceeding, claim or demand and of all negotiations in connection with the settlement or compromise thereof, except with respect to the assertion or defense of the privileges, immunities and facilities of ITU or any matter relating thereto, for which only ITU itself is authorized to assert and maintain. ITU shall have the right, at its own expense, to be represented in any such suit, proceeding, claim or demand by independent counsel of its own choosing. 12.4. In the event the use of any goods, property or services provided or licensed to the ITU by the Contractor, in whole or in part, in any suit or proceeding, is for any reason enjoined, temporarily or permanently, or is found to infringe any patent, copyright, trademark or other intellectual property right, or in the event of a settlement, is enjoined, limited or otherwise interfered with, then the Contractor, at its sole cost and expense, shall, promptly, either: 12.4.1. procure for ITU the unrestricted right to continue using such goods or services provided to ITU; 12.4.2. replace or modify the goods or services provided to ITU, or part thereof, with the equivalent or better goods or services, or part thereof, that is non-infringing; or 12.4.3. refund to ITU the full price paid by ITU for the right to have or use such goods, property or services, or part thereof. 12.5. The obligations under this Section do not lapse upon termination or completion of the Contract.	
16. Copyright, patents and other proprietary rights	16.1. Except as otherwise expressly provided in writing in the Contract, ITU shall be entitled to all intellectual property and other proprietary rights including, but not limited to, patents, copyrights, and trademarks, with regard to products, processes, inventions, ideas, know-how, or documents and other materials which the Contractor has developed for ITU under the Contract and which bear a direct relation to or	Contractor may use data, software, designs, utilities, tools, models, systems and other methodologies and know-how ("Materials") that contractor own in performing the Services. Notwithstanding the delivery of any Reports, contractor retain all intellectual property rights in the Materials (including

	are produced or prepared or collected in consequence of, or during the course of, the performance of the Contract, and the Contractor acknowledges and agrees that such products, documents and other materials constitute works made for hire for ITU. 16.2. To the extent that any such intellectual property or other proprietary rights consist of any intellectual property or other proprietary rights of the Contractor: (i) that pre-existed the performance by the Contractor of its obligations under the Contract, or (ii) that the Contractor may develop or acquire, or may have developed or acquired, independently of the performance or its obligations under the Contract, ITU does not and shall not claim any ownership interest thereto, and the Contractor grants to ITU a worldwide, perpetual, royalty-free license to use such intellectual property or proprietary rights. 16.3. At the request of ITU, the Contractor shall take all necessary steps, execute all necessary documents and generally assist in securing such rights and transferring or licensing them to ITU in compliance with the requirements of the applicable law of the Contract. 16.4. Subject to the foregoing provisions, all maps, drawings, photographs, mosaics, plans, reports, estimates, recommendations, documents, and all other data compiled by or received by the Contractor under the Contract shall be the property of ITU, shall be made available for use or inspection by ITU at reasonable time and in reasonable places, shall be treated as confidential, and shall be delivered only to ITU authorized officials on completion of the work under the Contract.	any improvements or knowledge developed while performing the Services), and in any working papers that contractor compile and retain in connection with the Services. Upon payment for the Services, ITU may use any Materials included in the Reports, as well as the Reports themselves as permitted by this Agreement."
20. Audit and nvestigations	20.1. Each invoice paid by ITU shall be subject to a post-payment audit by auditors, whether internal or external, of ITU or the United Nations or by other authorized and qualified agents of ITU or the United Nations at any time during the term of the Contract and for a period of three (3) years following the expiration or prior termination of the Contract. ITU shall be entitled to a refund from the Contractor for any amounts shown by such audits to have been paid by ITU other than in accordance with the terms and conditions of the Contract. 20.2. ITU may conduct investigations relating to any aspect of the Contract or the award thereof, the obligations performed under the	Contractor should provide the ITU or its auditor (bound by respective confidentiality obligations) upon request of the ITU with all the information and documents directly related to the engagement, without granting access to the contractors premises.

	Contract, and the operations of the Contractor generally relating to performance of the Contract at any time during the term of the Contract and for a period of three (3) years following the expiration or prior termination of the Contract. 20.3. The Contractor shall provide its full and timely cooperation with any such inspections, post-payment audits or investigations. Such cooperation shall include, but shall not be limited to, the Contractor's obligation to make available its personnel and any relevant documentation for such purposes at reasonable times and on reasonable conditions and to grant to ITU access to the Contractor's premises at reasonable times and on reasonable conditions in connection with such access to the Contractor's personnel and relevant documentation. The Contractor shall require its agents, including, but not limited to, the Contractor's attorneys, accountants or other advisers, to reasonably cooperate with any inspections, post-payment audits or investigations carried out by ITU or the United Nations hereunder.	
Suggestion: **Disclosure of EY Reports to Third Parties**	**ITU requests the right to disclose EY Reports to third parties**	ITU may not disclose any information, advice, recommendations or other content of any reports, presentations or other communications that contractor provide under this Agreement ("Reports") or any portion or summary of a Report or refer to contractor or to any other contractor Firm or contractor Person in connection with the Services to any third party."
21. Termination	21.1. Either party may terminate this Contract for cause, in whole or in part, upon thirty (30) calendar days' notice, in writing, to the other party. The initiation of arbitral proceedings in accordance with Section 29 below shall not be deemed a termination of this Contract. 21.2. ITU may terminate forthwith this Contract at any time by providing written notice to the Contractor in any case which the mandate of ITU applicable to the performance of the Contract or the funding of ITU applicable to the Contract is curtailed or terminated, whether in whole or in part. In such a case the Contractor shall be reimbursed by ITU for all reasonable costs incurred by the Contractor prior to receipt	Contractor may terminate this Agreement, or any particular Services, immediately upon written notice to ITU if contractor reasonably determine that they can no longer provide the Services in accordance with applicable law or professional obligations

	of the notice of termination. In addition, unless otherwise provided by the Contract, ITU may terminate the Contract without cause upon sixty (60) calendar days' written notice to the Contractor. 21.3. Should the Contractor be adjudged bankrupt, or be liquidated or become insolvent, or should the Contractor make an assignment for the benefit of its creditors, or should a Receiver be appointed on account of the insolvency of the Contractor, or the Contractor offers a settlement in lieu of bankruptcy or receivership, or should ITU reasonably determine that the Contractor has become subject to a materially adverse change in its financial condition that threatens to substantially affect the ability of the Contractor to perform any of its obligations under the Contract, then ITU may terminate this Contract forthwith. The Contractor shall immediately inform ITU of the occurrence of any of the above events. 21.4. In the event of any termination of the Contract, ITU shall be entitled to obtain reasonable written accountings from the Contractor concerning all obligations performed or pending in accordance with the Contract. No payment shall be due from ITU to the Contractor except for work and services satisfactorily performed in conformity with the express terms of this Contract, and only if such work or services were ordered, requested or otherwise provided prior to the Contractor's receipt of notice of termination from ITU or prior to the Contractor's tendering of notice of termination to ITU. 21.5. In the event of any termination of the Contract, the Contractor shall, except as directed by ITU in the notice of termination or otherwise in writing: 21.5.1. take immediate steps to bring the performance of any obligations under the Contract to a close in a prompt and orderly sssmanner, and in doing so, reduce expenses to a minimum; 21.5.2. refrain from undertaking any further or additional commitments under the Contract as of and following the date of receipt of the notice of termination;	

	21.5.3. place no further subcontracts or orders for materials, services, or facilities, except as ITU and the Contractor agree in writing; 21.5.4. terminate all subcontracts or orders to the extent they relate to the Contract; 21.5.5. transfer title and deliver to ITU the fabricated or unfabricated parts, work in process, completed work, supplies and other material produced or acquired for Contract; 21.5.6. deliver all completed or partially completed plans, drawings, information and other property that, if the Contract had been completed, would be required to be furnished to ITU thereunder; 21.5.7. complete performance of the work not terminated, if any; 21.5.8. take any other action that may be necessary, or that ITU may direct in writing, for the minimization of losses and for the protection and preservation of any property, whether tangible or intangible, related to the Contract that is in the possession of the Contractor and in which ITU has or may be reasonably expected to acquire an interest. 21.6. The provisions of this Section are without prejudice to any other rights or remedies of ITU under the Contract or otherwise.	
29. Settlement of disputes and governing law	The Parties shall use their best efforts to amicably settle any dispute, controversy, or claim arising out of the Contract or the breach, termination, or invalidity thereof. Where the Parties wish to seek such an amicable settlement through conciliation, the conciliation shall take place in accordance with the procedure agreed between the Parties in writing. In the case of failure of such negotiations, the dispute shall be settled by a sole arbitrator to be nominated at the request of either of the Parties by the Court of Arbitration of the International Chamber of Commerce (ICC). The place of arbitration shall be Geneva. The language of arbitration shall be English. The arbitration shall be carried out in accordance with the Rules of Arbitration of the International Chamber of Commerce, as at present in force. The applicable substantive law shall be Swiss law. The arbitrator's ruling shall be binding and final upon the Parties and any recourse against this ruling to any court or tribunal shall be excluded.	The Parties shall use their best efforts to amicably settle any dispute, controversy, or claim arising out of the Contract or the breach, termination, or invalidity thereof. Where the Parties wish to seek such an amicable settlement through conciliation, the conciliation shall take place in accordance with the procedure agreed between the Parties in writing. In the case of failure of such negotiations, the dispute shall be settled by a sole arbitrator to be appointed by mutual consent of both the Parties, and the arbitration proceedings shall be held in New Delhi. The language of arbitration shall be English. The decisison of the

		arbitrator shall be final and binding upon the Parties. The agreement, and any non-contractual matters or obligations arising out of it or the services, shall be governed by, and construed in accordance with, the laws of Republic of India.

Ernst & Young SA
Place de Pont - Rouge 1
Case postale 1575
1211 Genève 26

Dominique Perron
Partner, Business Consulting
Ernst & Young SA
Place de Pont - Rouge
Case postale 1575
1211 Geneve 26ss

Place: Geneve
Date: 18th August-2022

7. Assumptions

EY has considered following assumptions for arriving at overall solution and scope of work of this RFP:

- EY assumes that ITU would identify a single point of contact (SPOC) for entire duration of this engagement who will be providing required support in terms of connecting with other stakeholders of the project and facilitate required information/inputs from various department. EY Onsite Project Manager will interact with ITU SPOC for all Technical & Administrative coordination
- It is assumed that ITU will provide cloud infrastructure for carrying out development, UAT, production deployment, Operations & maintenance activities.
- It is assumed that any software procurements would be out of scope of EY
- Many of the proposed software products available in community edition are also available in enterprise category. EY has proposed community edition of those products. In case ITU decides to use enterprise category products or support through vendor, cost for same shall be borne by ITU
- ITU will ensure that there are no delays due to dependency on other vendors/ITU / Integrating departments. In case of delays from ITU side, additional manpower deployed would be billed at the rate provided in financial proposal.
- We assume that all milestone or documents submitted by EY would be reviewed and approved in 15 days of Submission. In case of no comments received from ITU, same would be considered as deemed approved. Any invoicing for such milestones / document's approvals would be allowed.
- All the trainings would be provided from ITU Office in Geneva or through Webex/ video conferencing. Any travel required by EY trainer, ITU would arrange boarding and lodging arrangements.
- ITU would provide training Room(s), Internet Connectivity, Projector and Projector Screen, Audio Video communication devices, Desktop(s), mobile devices for the participants, Printer and training material for distribution
- Operations and maintenance team shall carryout: Incident Fix, Problem Fix and Maintenance INCIDENT classifies for change management of configurable items of solutions.
- SLAs for Operations & Maintenance (O&M) phase would be agreed between ITU and EY before start of O&M Phase.
- SLA Management & Monitoring of the EY scope is only limited to the application or software developed / maintained by EY.
- Availability Exception:
    - National holidays and other holidays as decided by ITU & constraints like natural calamity etc. in the city from where the support is provided.
    - Availability SLA of IM-BB Platform under this RFP is only limited to components provisioned by EY, non-availability of platform because of any failure in Hardware, Network or Datacentre, department applications will be out of scope for EY and will not be included in SLA breach.
    - Any planned or unplanned hardware, network downtime would not be counted towards SLA for EY.
    - Performance of application also depends on the Bandwidth and hardware provisioned by ITU for Cloud hence SLA for performance for IM-BB platform is only eligible once the required bandwidth and hardware is being provided.
- EY team would be monitoring the performance and availability of IM-BB Sandbox under scope of EY only. Monitoring of infrastructure related to IM-BB application would be done by EY team using the components mentioned in Technical solution. Limitation of technical components for monitoring purposes should be treated as external factor.
- A separate hosting environment is not being proposed. Instead, the Sandbox infrastructure provided by GovStack will be used. This will enable a smoother integration with other building blocks and thereby facilitating a faster time to market.

- Data backup and Archiving will be responsibility of cloud provider of ITU. EY will facilitate policies and required software scripts for data backup.
- We assume that EY scope of work related to O&M is limited to
    - Maintaining & monitoring IM-BB applications environment
    - monitoring and raising Alerts to infrastructure vendor for the server's performance which includes CPU, memory, alarms, storage and other aspects which must be through monitoring tools proposed in technical solution
    - Infrastructure services like maintenance, fine tuning and fixing of any related breakdown would be in scope of infrastructure / cloud service provider. EY responsibility is only limited to finetuning of IM-BB application for optimal usage of RAM, CPU Cores or infrastructure /services
- As part of Design, Development, and Implementation of a "Information Mediator Building Block" and integrate it within the overall GovStack sandbox environment, we have considered max 5 UI each for Admin and Security Server module. Additional UIs would be taken up as change request and would be charged as per T&M rates.
- As part of Training, one batch of training is covered in scope of work. ITU can request EY for additional trainings as change request and EY would charge ITU as per T&M rates.
- O&M phase covers support for IM-BB integrated within overall Govstack Sandbox. Support for onboarding additional client would be considered as change request and EY would charge ITU as per T&M rates.
- During implementation period, some of the resources would be deployed onsite for specific duration at ITU office in Geneva. We assume ITU will provide seating arrangements, networks/internet access.