
How “access points” give standards-based connections to procurement systems

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Elevator summary

The governments of Canada and Ontario have recently announced two new development projects for implementing and deploying centralized electronic procurement and invoicing for the suppliers to their respective ministries and departments. Initial indications in the tendering documents and on their web sites reveal these projects have not learned from the recent examples of other governments worldwide implementing systems with open and decentralized standards-based “access points”. The US electronic invoicing interoperability framework being developed recognizes the importance of using such, and there is an immediate opportunity for these two new Canadian projects to participate actively in the US effort and then embrace the use of the model in Canada for the benefit of Canadians.

Executive summary

As the governments of Canada and of Ontario each embark on new separate development projects for centralized procurement systems, it is critical that they consider worldwide examples of established practices in new approaches to open standards-based information exchange between trading partners.

Data, document, and information interoperability have evolved over the decades. I explain below the evolution of the 2-corner (direct), 3-corner (centralized), and 4-corner (decentralized) information networking models. The press announcements for both of the projects announced in Canada indicate each is to be a centralized system for all participants, thus indicating the use of the 3-corner model rather than the 4-corner model. Overlooking the decentralized 4-corner model will inconvenience certain groups of users and outright disenfranchise other groups.

Since 2008 the Pan-European Public Procurement On-Line (PEPPOL) project has implemented and formalized a set of specifications for decentralized secure and reliable information interchange using what is termed a 4-corner model, much like the 4-corner approach used in Internet email systems. The European PEPPOL has been adopted internationally by Australia, New Zealand, and Singapore, with other Pacific and Asian countries expressing interest.

In the U.S., the Federal Reserve is facilitating industry to specify its own 4-corner-model-based platform in order to streamline payments of supplier invoices. The overarching goal is “to make B2B payments more efficient across the end-to-end process, that is, to achieve straight-through-processing across both the procure-to-pay and order-to-cash cycles”. To this end, the Fed founded the Business Payments Coalition (BPC) and its committees to help industry come up with an industry-developed solution. Members of the BPC include banks, companies, vendors, and service providers, and the committee functioning is facilitated by the Fed.

The BPC is not imposing or constraining a buyer’s or seller’s existing ERP (Enterprise Resource Planning) or procurement system. Trading partners are expected to continue to use their many and varied procurement systems that likely differ from those of the other party.

Membership in the BPC is free of charge. The resulting specifications are free to use. Canadian requirements are being welcomed for consideration from Canada-based members of the BPC. In Canada, using the BPC specifications would introduce a new nationwide interoperability framework infrastructure for electronic invoicing and other procurement documents, integrated with that of our largest trading partner. Both Canada and Ontario operating their separate 3-corner-model procurement systems on a single 4-corner-model network would be a money saver for suppliers servicing both clients, would speed up the overall ordering/invoicing/payment process, and would reduce duplication in governance and oversight.

Looking beyond North America, Canada participates in international trade both with European nations in the Comprehensive Economic Trade Agreement (CETA) and with Pacific nations in the Trans-Pacific Partnership (TPP). And so, implementing an interoperability framework using the very same international standards as used in PEPPOL would position Canada centrally between the two economic blocs beyond the obvious geographical perspective.

Moreover, international experience demonstrates the flexibility and utility of a general purpose interoperability infrastructure beyond procurement to include such areas as ISO 20022 and the banking/finance messages for credit initiation and settlement.

I appeal to the two new Canadian-based 3-corner-model procurement projects to get actively involved in the BPC to ensure their requirements for Canada are reflected in the US specification so as to be able to adopt the US 4-corner-model specification without changes. Time is running out to do so.

And I appeal to the Canadian federal government to take a leadership role in establishing a nationwide interoperability framework infrastructure based on the BPC specifications in order to be used across the country for procurement, finance, jurisprudence, health care, transportation, and many other sectors.

Disclaimer

The opinions and perspectives in this essay are entirely those of Crane Softwrights Ltd. and do not in any manner necessarily represent the views or positions of the US Federal Reserve Bank, the Business Payments Coalition, the OASIS Business Document Exchange Technical Committee, or the OASIS Universal Business Language Technical Committee.

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1. Introduction

Late in 2015 I wrote the essay “Open specifications open marketplaces!” [Open Marketplaces] documenting how other countries have been ahead of the US and Canada in establishing and adopting standardized practices regarding document exchange for electronic invoicing in business. I won’t reiterate here the details of the examples I document there of successful independent deployments in Europe and Australia, nor the examples of unsuccessful US and Canadian efforts at the time to implement archaic “invoicing portals” or other so-called 3-corner-model-based solution architectures. But I do note that recently Australia, New Zealand, and Singapore all have announced their intentions to implement nationwide interoperability networks joint with the European PEPPOL 4-corner-model-based platform that I documented in the essay.

The U.S. Federal Reserve Bank of Minneapolis took note of those projects identified in that essay and took on an initiative in October 2017 announcing support for a three-year plan under the moniker “Payments Efficient strategy”, one of the overall Federal Reserve System Strategies for Improving the US Payment System (SIPS). The strategy, in part, calls for industry to specify its own 4-corner-model-based interoperability platform in order to streamline payments of supplier invoices. The Business Payments Coalition [BPC], facilitated by the Fed, formed two working groups to collaboratively select the technologies and refine a formal interoperability specification, drafts of which already are in public review. This supports the coalition’s overarching goal “to make B2B payments more efficient across the end-to-end process, that is, to achieve straight-through-processing across both the procure-to-pay and order-to-cash cycles”. Members of the BPC include banks, companies, vendors, and service providers, and the committee functioning is administered by the Fed. The e-Invoicing committee charter [eInvoicing charter] reads in part:

“... collaborates with stakeholders to explore the possibility of developing and implementing a standard, ubiquitous B2B electronic invoice and processing platform similar to ones that have been developed in other countries.”

The BPC is not imposing or constraining any buyer’s or seller’s existing ERP (Enterprise Resource Planning) or procurement system. Buying agencies/ministries/departments and participating vendors/suppliers are expected to continue to use their many and varied procurement systems or small business software packages as they have always done. Whatever works for each, and the systems do not need to be the same.

The BPC is not looking only at government-oriented trading scenarios. Very shortly after the launch of the government-oriented PEPPOL platform the business-to-business adoption and use of the platform far outpaced that of ministries and their suppliers. Indeed the BPC is an industry-led effort and government is participating solely as being a part of industry. The role of the US Fed is that of a facilitator helping industry in its development of the interoperability framework.

The BPC is building the set of requirements for a decentralized B2B electronic invoice and business information distribution platform that is secure, reliable, ubiquitous, and based on international standards. It is intended that this will become a national standard interoperability framework accommodating existing and future participants in effectuate information interchange. While they are starting with the electronic invoice, the electronic purchase order and electronic remittance advice already are on the horizon because of the charter cited above to eventually achieve straight-through-processing. This all is in support of their initiatives to promote faster payments to suppliers, thus supporting money getting into the economy more quickly[Next steps], and reduce their own payment of late penalties[Prompt Payment].

In Canada two new electronic procurement implementation contracts recently have been awarded, one for the government of Ontario[Ontario], and one for the government of Canada[Canada]. The press announcements for both of these projects indicate each is to be a centralized system for all participants, thus indicating the use of the 3-corner model rather than the 4-corner model. It remains to be seen from the encouraging quotes “to modernize how services [in Ontario] are delivered” and “The Government of Canada is applying lessons learned from other information technology projects in developing and implementing the electronic procurement solution” whether or not these projects are open to the use of the same 4-corner model as already implemented in Europe in the PEPPOL[OpenPEPPOL] and CEF eDelivery [CEF eDelivery] projects, and as being implemented in the US by the BPC.

Moreover, these projects are destined to replace an existing hodgepodge of diverse ERP and procurement systems with a single system for each jurisdiction. Updating a buyer’s system can have incredibly negative impact on sellers, and such impact can be repeated without proper planning. The 4-corner model can play a critically important role in minimizing the impact on suppliers of changes in the buyers’ systems.

While the focus of the BPC explicitly is the domestic US marketplace, the group is also explicit in their objectives to support cross-border requirements. Accordingly, they have opened their table to anyone to participate. Membership is free of charge. The resulting specifications are free to use. I and a small number of other Canadian representatives, as well as a number of representatives from Mexico, are actively involved in determining the BPC specifications. In doing so, we try to ensure Canadian domestic and Mexican domestic requirements are satisfied so that both countries can be in a position to adopt the US specification as our own. More Canadian input is needed.

The BPC will be recommending the OASIS BDXR[BDXR TC] family of 4-corner model specifications donated to OASIS by PEPPOL (using it for procurement), and used by CEF (using it for many different domains), and so its use will be familiar to international implementers already working with these techniques, many of whom do business also in North America. Many open-source implementations [PEPPOL Open Source][CEF Open Source] of the 4-corner-model access point software are available free to use, modify, and deploy. For the benefit of readers, I outline below the overall operation of the 4-corner model and, for the interest of a few, a technical deep-dive into the all-important service discovery steps.

The BPC also will be recommending the OASIS Universal Business Language (UBL) ISO/IEC 19845[UBL 2.1 - ISO/IEC 19845], created and maintained by the vendor-independent UBL Technical Committee[UBL TC], for the network format for translated procurement documents as it is in PEPPOL. UBL has been adopted as a Canadian national standard[UBL Canadian Standard]. Encouragingly, the Government of Canada procurement project statement of work[SOW] identifies UBL as a candidate structured file format (requirement F-03.06 on page 133).

In Canada, using the BPC specifications would introduce a new nationwide electronic invoicing format and information interoperability platform integrated with that of our largest trading partner. In Mexico, using the BPC specifications would enable ease of integration with that country’s existing electronic invoicing environment.

And looking beyond North America, Canada participates in international trade both with European nations in the Comprehensive Economic Trade Agreement (CETA) and with Pacific nations in the Trans-Pacific Partnership (TPP) and so implementing an interoperability framework using the very same international standards as used in PEPPOL would position Canada centrally between the two economic blocs beyond the obvious geographical perspective.

As an example to the two new Canadian-based 3-corner-model procurement projects, I document below how the accommodation of a 4-corner model works and how it can be integrated without changing a 3-corner-model implementation.

And as an example to existing 3-corner-model procurement projects, I document below how a 4-corner model can support a migration and modernization effort without impacting on stakeholder vendors.

Both Canada and Ontario operating their separate 3-corner-model procurement systems on a single 4-corner-model network would be a money saver for suppliers servicing both clients, would speed up the overall ordering/invoicing/payment process, and would reduce duplication in governance and oversight.

Also, international experience demonstrates the flexibility and utility of a general purpose interoperability framework beyond procurement to include such areas as ISO 20022 and the banking/finance messages for credit initiation and settlement.

I conclude with two appeals:

First, to the two new Canadian-based 3-corner-model procurement projects – get actively involved in the BPC to ensure your requirements for Canada are reflected in the US specification so as to be able to adopt the US 4-corner-model specification without changes. Time is running out to do so.

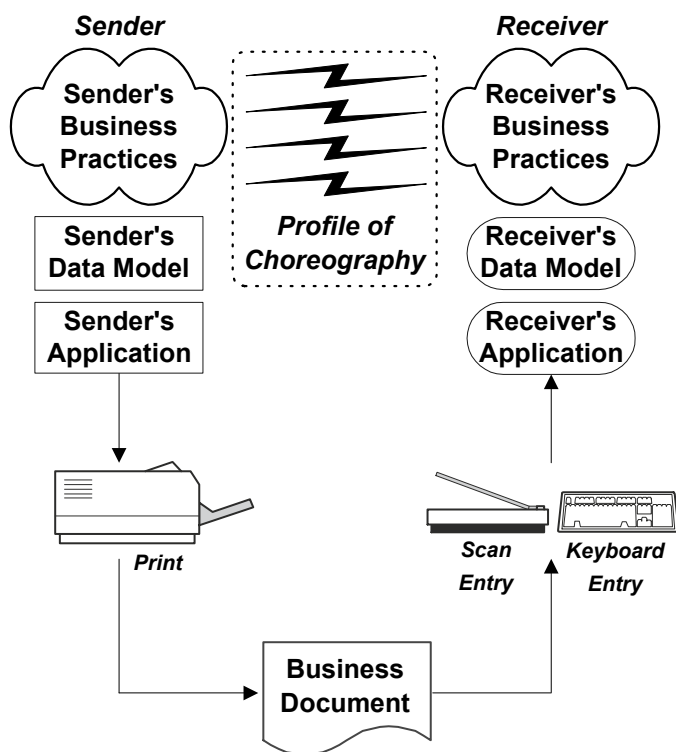
Second, the Canadian federal government to take a leadership role in establishing a nationwide interoperability framework based on the BPC specifications in order to be used across the country for procurement, finance, jurisprudence, health care, transportation, and many other sectors.

2. Historical approaches to business document interchange

The choreography of business has evolved over the centuries into what we know today as commerce. Our business practices have evolved along with that choreography in order to be able to interact with our trading partners in the successful conclusion of trade. Those business practices employed the use of familiar paper documents such as purchase orders, invoices, waybills, and such.

The advent of computers did not immediately replace the paper documents, but it did change the way the paper documents are created and consumed. The sender of a document has a computer program that prints the information into conventional locations on the page, and with recognizable arrangements and labels used to identify the critical data. That data is arranged for or by the computer program using a model in alignment with the sender’s business practices. Such alignment may be quite different than that needed by the receiver’s business practices, though the data itself are commonly understood by both. The receiver’s computer program somehow ingests the information found on the printed page, be it by scanning or data entry, both of which are susceptible to errors. That information is interpreted as the data needed by the program and organized according to the model aligned with the receiver’s business practices. This is illustrated as follows.

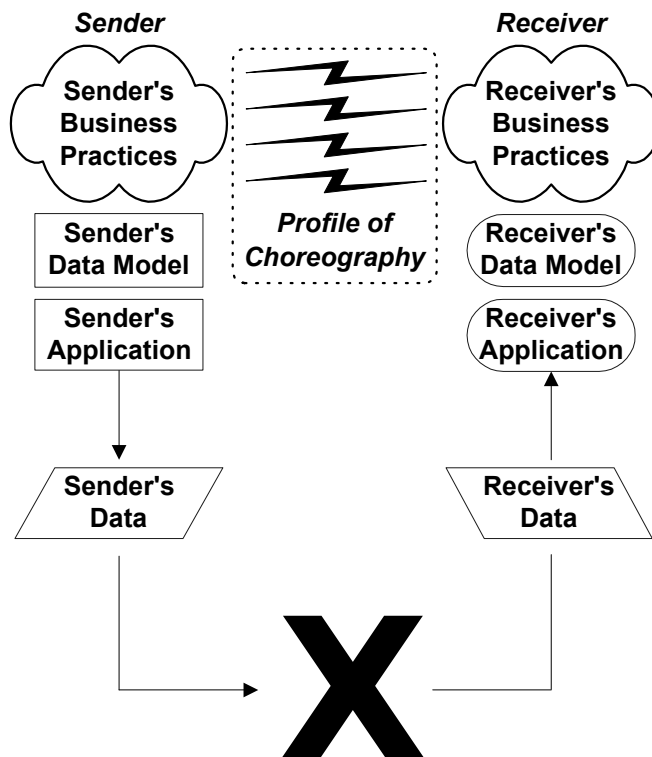
Figure 1. Before electronic document formats



Replacing the paper business document with an electronic business document was the next logical step in digitizing the process. In what has been labeled a 2-corner model, the two corners being the sender and the receiver, the connection between the two is direct. This requires the receiver to ingest into the receiver's data model that information the sender has transmitted electronically from the sender's data model.

However, it transpired that the sender's application would be hardwired to reify the sender's data in one format, while the receiver's application would be hardwired to ingest its information in a different data format. There was no interoperability without one party (usually the bigger of the two by some criteria) mandating that the other party change their expectations for the format of the agreed-upon data. Doing business with multiple trading partners inevitably requires supporting multiple data formats, exacerbating the problems and the efforts to support of the many electronic relationships.

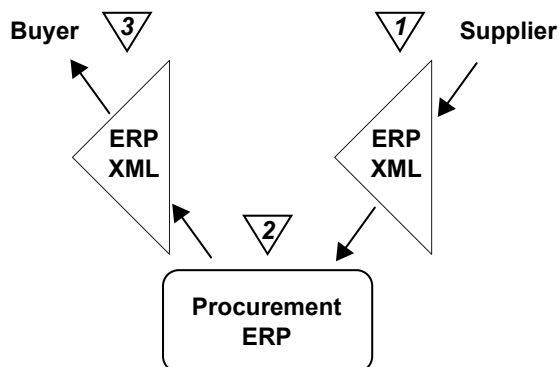
Figure 2. Conflicting electronic document formats in a 2-corner model



It then became de rigueur for a third party to be injected between the sender and receiver, providing both parties with a centralized repository and/or document-handling service, usually as part of an Enterprise Resource Planning (ERP) tool. When handling procurement, such a system would be between the supplier issuing invoices and the particular buyer. Typically, a large buyer would impose the use of their ERP system on their many suppliers. The ERP system would dictate the document format to be used by all parties, and often that document format is a proprietary vocabulary unique to the ERP vendor.

Such a tool would be billed quite likely as a “portal” or “single window” application. In fact, it is an instantiation of a 3-corner model where, for example for procurement, the supplier (corner 1) expresses their supplier data in the ERP’s proprietary vocabulary and sends it to the portal’s procurement ERP system (corner 2) which would then make it available to the buyer (corner 3) again in the ERP’s proprietary vocabulary.

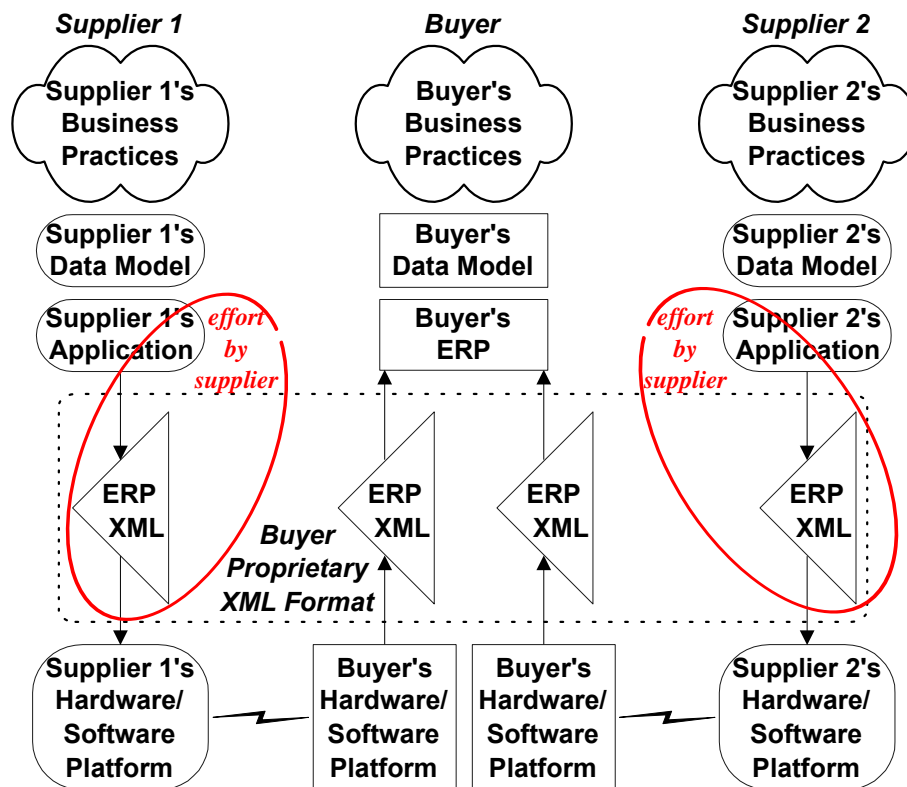
Figure 3. The 3-corner model and common document formats



3. The attraction to big buyers of the 3-corner model

When using the 3-corner model, the attraction to big buyers is that they don't have to change their ERP system or their data model in order to be able to ingest the information from many and varied suppliers. They simply push to the supplier the effort needed for transformation of the supplier's data into the buyer's data formats.

Figure 4. Single 3-corner models



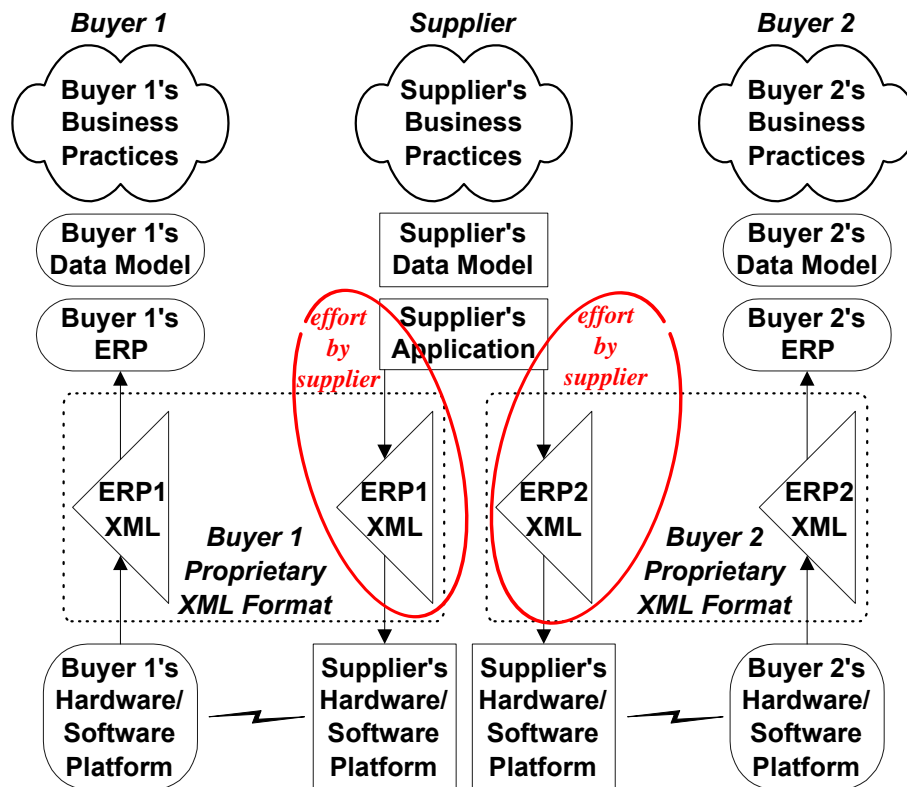
This is readily portrayed by buyers to sellers as “just change the way you express your data once, and from now on the central ERP system will be able to handle anything that you send to us”. It sounds simple. In fact, this is a common theme in the press releases of both the procurement systems being deployed by the governments of Ontario and Canada. Both are making the effort to simplify the work of suppliers to be able to do business with each of them.

4. The impact on suppliers of the 3-corner model

The impact on suppliers, however, is far from being simple.

Consider one supplier that happens to be a common supplier to two buyers. They are selling to each of the governments of Ontario and Canada. The conversion effort pushed down to them by the two suppliers is twice the work of having only one buyer to deal with.

Figure 5. Multiple 3-corner models



And most suppliers won't have only two trading partners. The mismatched data representations, even if the document formats are identical, exacerbate the issue just as what happened in the world of using the two-corner model. Progress may have been made for the buyer, but progress has not been made for the many suppliers. And when the buyer is the government, they are supposed to be serving the needs of the suppliers and so should be making the supplier's task easier.

5. The openness of the 4-corner model

The 4-corner model introduces two intermediaries between the trading partners. There are many exemplars in our world today where each communicating party employs the use of their own intermediary. The two intermediaries are responsible then for conveying the information between each other.

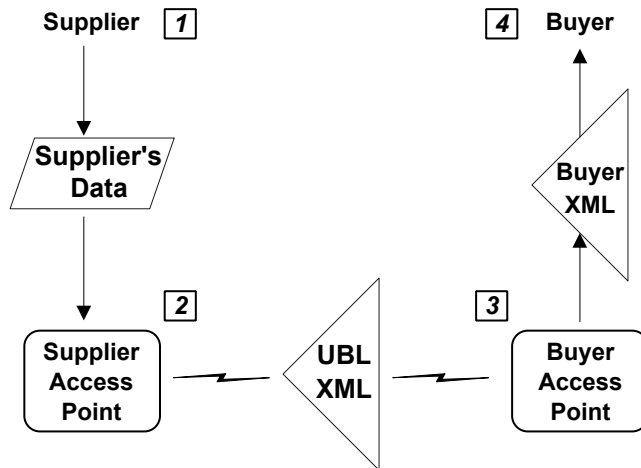
The postal service is one example. When a Canadian (corner 1) addresses a letter to a US recipient, they do not deal with the US Postal service, they deal with Canada Post (corner 2). They have a private relationship with Canada Post that has nothing to do with the functioning of any other mail system in the world. But Canada Post does have a direct relationship with the USPS (corner 3) identified by the letter's address, and so through international agreements conveys the letter obtained from the sender to the USPS. In turn, the USPS forwards the letter to the recipient (corner 4) according to a private relationship that has nothing to do with any other mail system in the world. The entire system is open to any citizen worldwide by their official postal service committing to the international agreements between countries. The postal services are access points to their customers in providing the service of mail delivery.

The cellular telephone service is another example. A caller (corner 1) making a phone call with a 3G phone to their cellular company (corner 2). Their cellular company determines whom to connect with as a cellular supplier (corner 3) based on the phone number. That cellular supplier connects with the callee (corner 4) who might answer the phone call with a 4G phone. The technologies of the telephones are not compatible, yet they are talking together on their phones. The use of international standards between the cellular providers bridges the incompatible technologies. The cellular services are access points to their customers in providing the service of a telephone connection that includes technology translation.

These were the inspirations to the creators of PEPPOL in conceiving the openness of their interoperable information transmission system for economic operators in their communities. Their objective was to prevent the disenfranchising of any participant by allowing that participant to be represented in the network by an access point willing to assume the responsibilities of operating on the network. The connection between any participant and their access point provider is private and can be in any format. The connection between access point providers is prescribed to be a common internationally-standardized document format that accommodates the agreed-upon repertoire of information needed at a semantic level to be sent from sender to receiver.

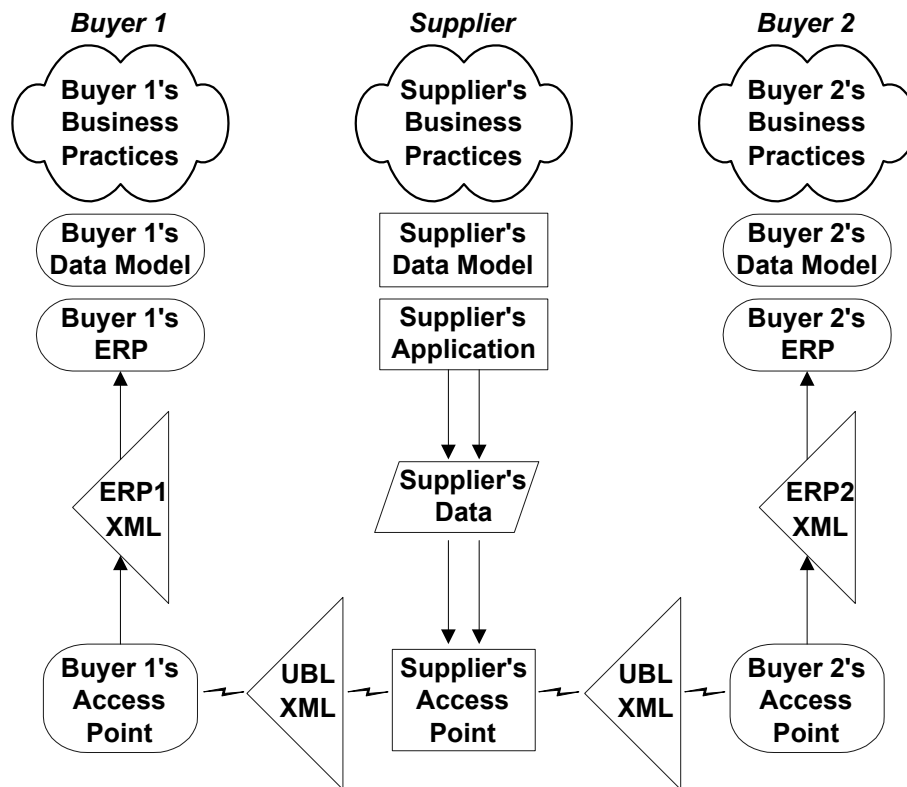
First consider how this looks between a supplier and a buyer. The supplier (corner 1) needs to send an invoice to the buyer and so sends from their system their supplier data to the supplier’s access point (corner 2). It can be in any format, so let’s use unstructured CSV files as an example. The supplier’s access point interprets the data and populates an ISO/IEC 19845 UBL structured XML document with the information found in the CSV fields. That UBL XML document is sent to the buyer’s access point (corner 3). The buyer has a procurement system with a proprietary XML format and so the buyer’s access point takes the information out of the UBL XML format and puts it into the buyer’s proprietary XML format and sends it to the buyer (corner 4). The buyer only ever sees its own XML format and doesn’t need to know whatever format the supplier might have used to express the data the buyer has received.

Figure 6. Single 4-corner models



Now consider how this looks between that same supplier and two buyers who have differing proprietary XML formats based on two competing ERP systems. Nothing changes for the supplier, as they continue to send their invoices using their private CSV format to their access point regardless of whatever format the buyer may wish to use. And nothing changes for the buyer as they continue to receive the supplier data in their respective proprietary XML formats they’ve always supported.

Figure 7. Multiple 4-corner models



This model is infinitely extensible to any number of access points for any number of participants in the community. The burden of supporting any one format is pushed to only one access point, and that access point becomes interoperable with every other access point by using the internationally-standardized format.

Moreover, one access point provider may provide multiple access points for the same or different participants. This creates a business opportunity for the provision of access point services to clients. An enterprising access point provider can service a formerly disenfranchised community of users by catering to their specific requirements in a way competing with other access point providers. An entire marketplace of access point provision creates new businesses and new employment.

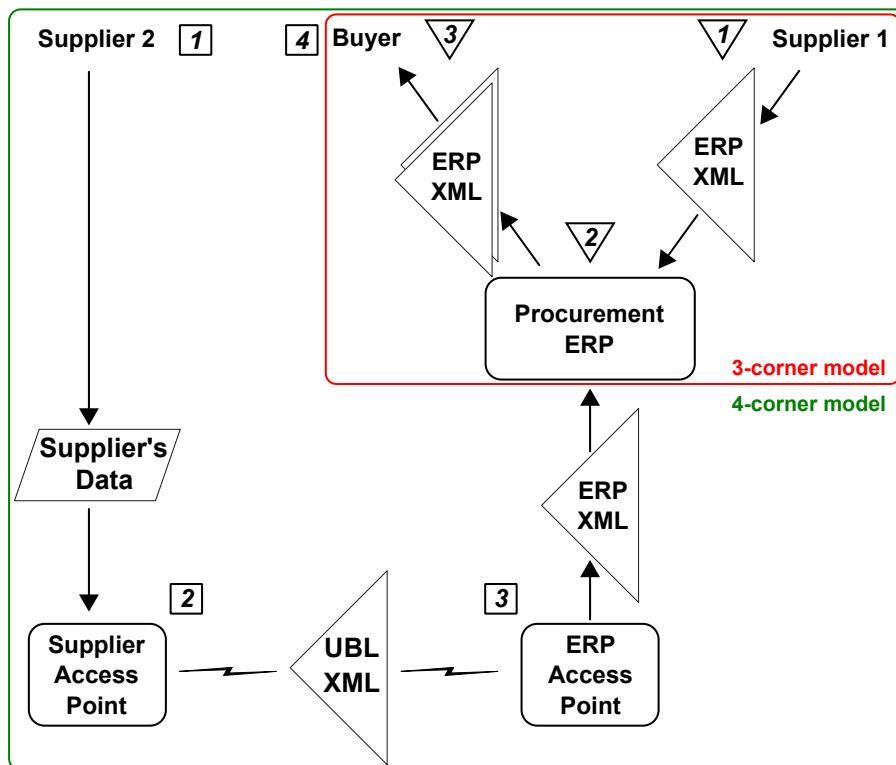
And having adopted the same open international standards as used elsewhere in the world, a Canadian implementation of this BPC-specified US platform in Canada will be readily adaptable to cross-border interoperability with other jurisdictions. This is a very forward-looking stance both for domestic support and international support.

6. Using the 3-corner model in the 4-corner model

All is not lost for existing or even future 3-corner-model implementations in a 4-corner-model world. Consider that that very same ERP XML format supported by the ERP system receiving documents directly from, say, supplier 1 can be used to send supplier 2's document content from the access point connected to the ERP system.

Of course supplier 2 still needs to be onboarded as a supplier to the ERP system, all that changes is the method by which supplier 2 gets its supplier document data into the ERP system contrasted to how supplier 1 gets its supplier document data into the ERP system.

Figure 8. A 4-corner model with a 3-corner model



This is why the two procurement projects for the governments of Ontario and Canada should be interested in having a Canada-wide network of access points using UBL XML. Any supplier on the nationwide network can be onboarded onto any ERP system on the network and their information transmittal obligation to the ERP system is satisfied without any changes to their document creation software.

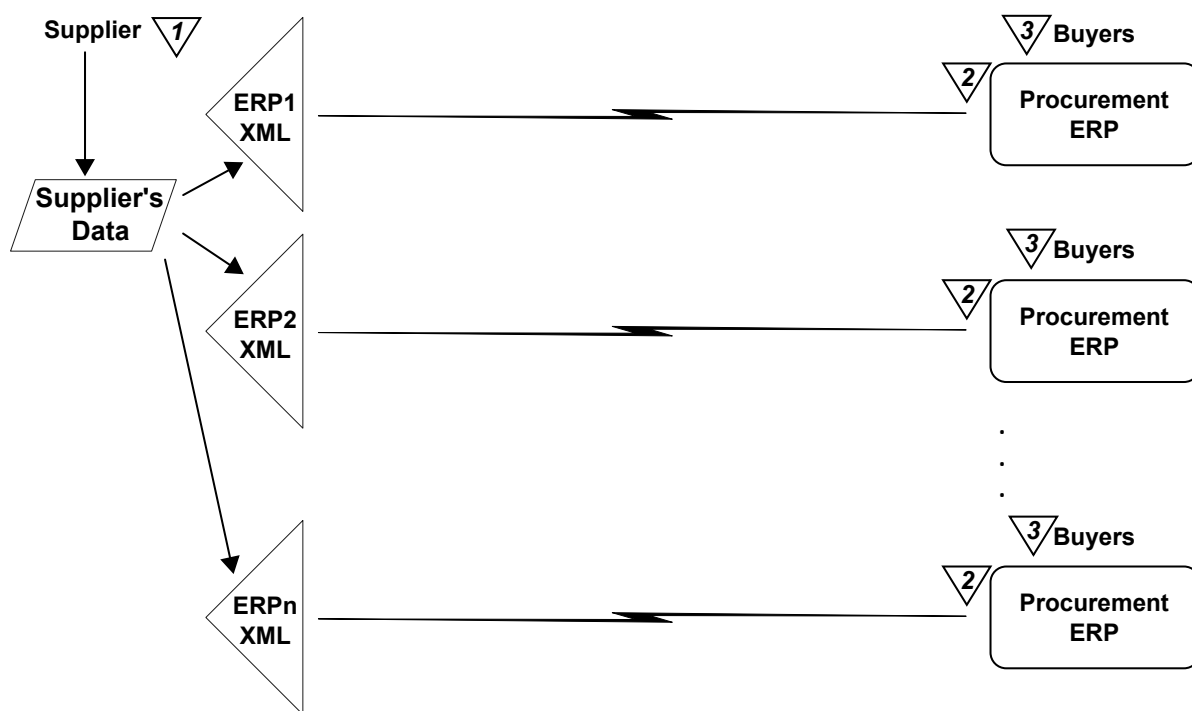
And so, therefore, both projects should be participating in the BPC to ensure the information the projects need for their systems will be able to be completely expressed by a remote participant's access point when converting that participant's private document format into UBL XML.

7. Migrating multiple back-end ERP systems

Over the years in my discussions with various Canadian federal government departments, I've heard there may be upwards of 12 or even 17 different existing procurement platform configurations as instances of four or five differing brands of procurement platform software. And I've long heard of the desire to consolidate these many variants into a single procurement platform. Perhaps the recent announcement of the government of Canada procurement project development is going to be that be-all and end-all one procurement system. But consider the impact on suppliers and the staggered decommissioning of the many buyer systems. For a long time there will continue to be a mishmash of data formats and content requirements across the existing systems.

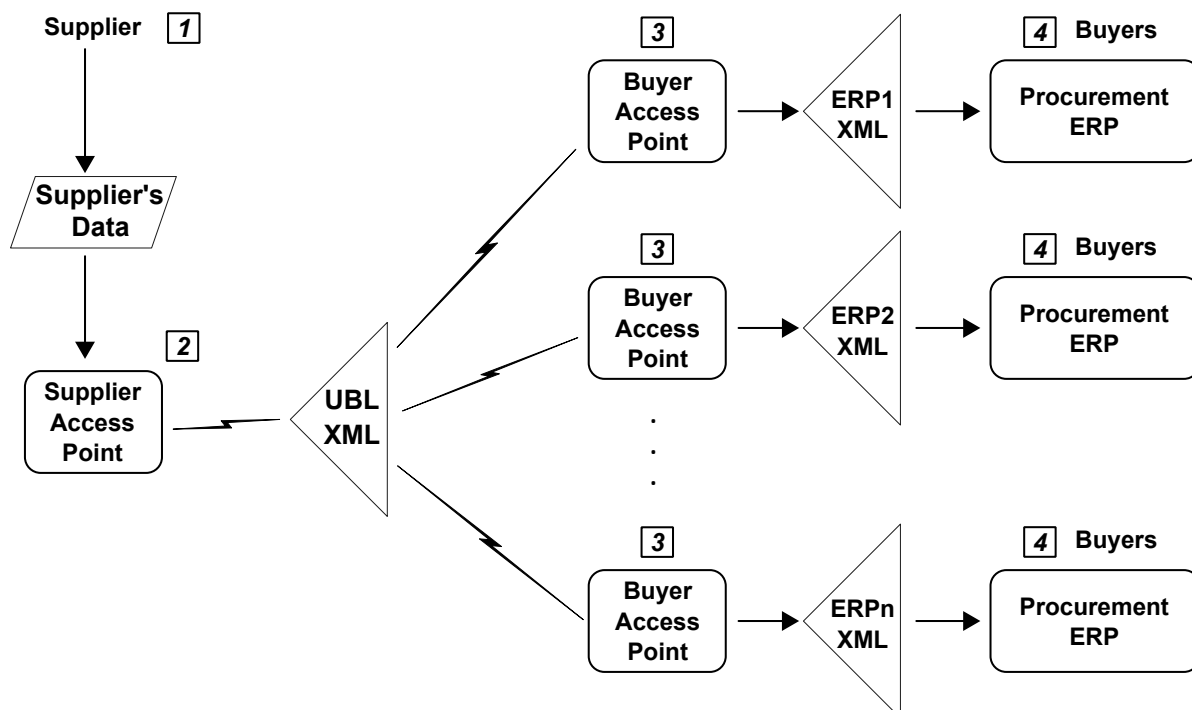
As it is, suppliers already need to support multiple formats for multiple 3-corner-model systems, taking on the responsibility and burden of converting their supplier data for their business document into the differing formats required by each ERP system.

Figure 9. Interacting individually with multiple ERP systems



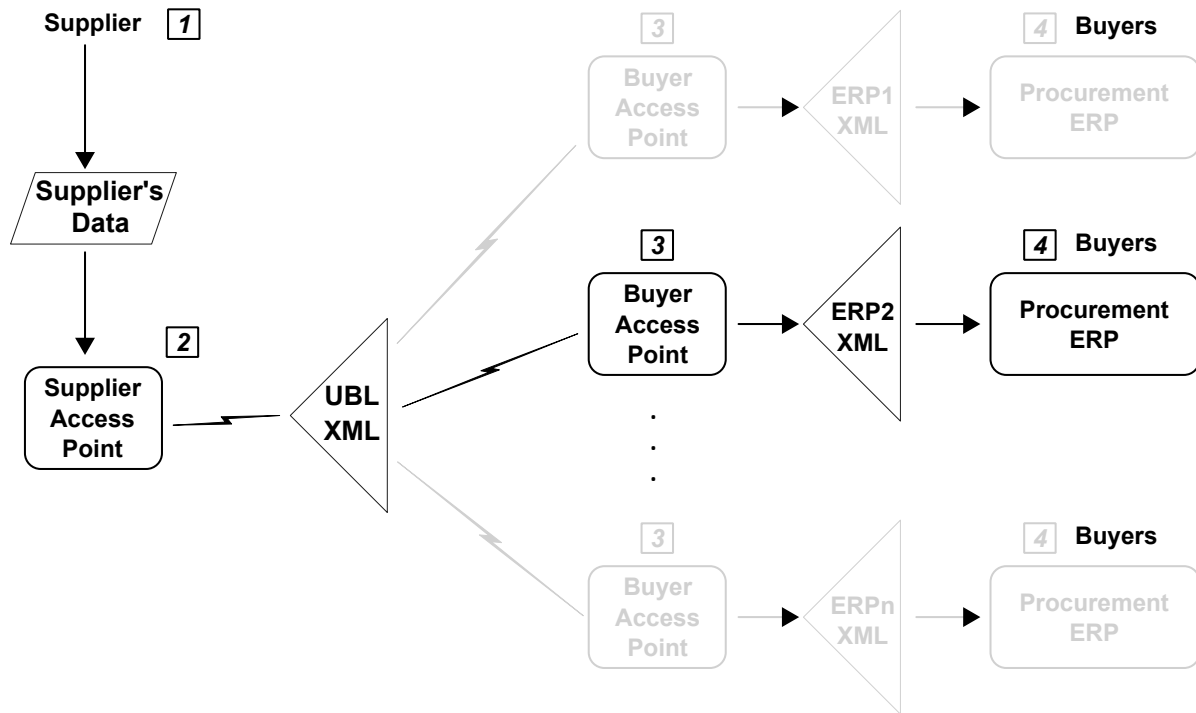
However, if the first step of migration is to put each and every one of the existing 17 procurement systems onto a 4-corner model network, then the burden of the thousands of suppliers is to change their document transmission once to be in their own private and natively-defined format between them and their own access point. They do this once and though they could choose to send the legacy system format to their access point, they could streamline their process by using a format native to their software. They may even choose to become their own access point and be two of the four corners themselves by committing to the access point obligations without the need to hire the services of another company.

Figure 10. Bridging multiple back-end ERP systems with access points



Once all of the systems are on the one 4-corner model network, the government of Canada can then, at their own pace, reconfigure, consolidate, decommission, or do whatever they need to do to create their one ERP system and there is no further impact on any of their suppliers. Their suppliers don’t even need to know when anything has changed or even that anything has changed because they only talk to their access point, and their access point only talks with other access points.

Figure 11. Migrating multiple back-end ERP systems with no supplier impact



This approach has a one-time impact on each of the participants to get up and running, using the data format of their own choice. There will be no impact as participants change the way they interact with their own access points. The access points need only support the conversion of their client’s private format to and from the common network format, without needing to support any of the formats of trading partners.

8. Looking towards ISO 20022 opportunities

In October 2017 the U.S. Federal Reserve announced plans to complete their migration to the ISO 20022 Universal financial industry message scheme [ISO 20022] for their real-time gross settlement system, the Fedwire Funds Service. In the world of payments, credit transfer, clearing and settlement, the emphasis first is for wires and then later for automated clearing houses. The Fed is engaging and enlightening US businesses and other interested parties in the use of this international standard for payments.

The road to ISO 20022 started at Payments Canada (formerly the Canadian Payments Association) in 2013 and by 2016 end-to-end payment message flows using ISO 20022 implemented a cross-country payment clearing and settlement system using this open standard [Payments Canada].

The European Payments Council Single Euro Payments Area relies on ISO 20022, as well as the Australian Payments Clearing Association. The standard is well ensconced and a day-to-day reality for many financial sectors around the world.

But in Europe and Australia the focus has continued on beyond payments and into the realm of business processes that trigger the need for payments. The focus has been on procurement and, recently in Europe, on transportation. The initial driver in Europe has been government procurement. The initial driver in Australia has been whole-of-economy efficiency.

The BPC driver is electronic payments, and the electronic invoice is but one procurement document in support of getting paid electronically and quickly. Straight-through processing matches an electronic invoice to an elec-

tronic order. Reconciliation matches an electronic remittance advice to an electronic invoice. Working together, communities adopting the BPC infrastructure will automate important steps resulting in the faster triggering and settlement of payments. This meshes very well with the Fed objectives for ISO 20022.

Already in Norway banks and companies are using the OASIS-defined 4-corner-model PEPPOL infrastructure in that country for the secure exchange of actual untouched ISO 20022 documents, eschewing the traditional ISO 20022 transmission means:

Enhanced use of the PEPPOL infrastructure[Norway PEPPOL]

In addition to the use of the PEPPOL infrastructure for eProcurement, Difi has started to use it in a more general eGovernment context. The ISO 20022 payment implementation[Norway ISO20022] is using the PEPPOL infrastructure added with an extra layer of end-to-end (corner1-corner4) security (Secrecy, Authenticity, Integrity and Traceability)

Establishing a nationwide secure and reliable interoperability framework opens up the opportunity for different economic sectors to leverage the platform for their own use, as exemplified by the CEF eDelivery case studies.

Implementing such a BPC framework in Canada would give options to consider for procurement documents, for transportation documents, for ISO 20022 financial documents, and yet others on the one nationwide infrastructure.

9. Conclusions: How Canada and Ontario can move forward on this

The Government of Canada has talked a long time about open standards and open source policies. The latest of which that I’ve seen formally expressed is in a memorandum of understanding between the Treasury Board of Canada Secretariat and the Department of Digital, Culture, Media and Sport, of the United Kingdom of Great Britain and Northern Ireland [MOU] in October 2017 where I see:

3. They commit where possible to working towards and conducting their activities based upon the following principles of digital development...

...

ii. **open standards** – technology requires interoperability and so a clear commitment to a credible royalty free open standards policy is needed;

iii. **open source** – future Government systems, tradecraft, manuals and standards are created as open source where appropriate and are shareable between members;

iv. **open markets** – in government procurement create true competition for companies regardless of size. Encourage and support a start-up culture and promote economic growth through open markets;

...

Great talk, but for over a decade I have been trying to convince the government to look into the existing open and free-to-use electronic invoicing specifications that now are backed up with available open-source solutions. The procurement projects for both Ontario and Canada appear to continue to look at archaic legacy solution architectures, in particular the 3-corner-model portal or single window concept and proprietary document formats. Such is not the way of the future, and it hasn’t been for a while now that the European 4-corner model is being adopted worldwide, including the US. It is time for Canada to get involved.

Surely the vision of the BPC and its interoperability framework working groups promote these important principles of open standards, open source, and open markets. And if Canada has the stomach to try to address an all-of-economy e-invoicing solution and attempt to catch up to other countries on its own, then now is the time to do so when its largest trading partner is already well underway to implementing such.

More Canadian companies, governments, and projects need to be directly involved in the day-to-day creation and evaluation of the BPC work products, so that these US specifications can be adopted. And the Norwegian example of using a single infrastructure for procurement, for ISO 20022, and for other application areas is especially interesting for banks and payment systems in Canada to consider. I expressly call on the Ontario and Canada procurement projects to get on board to ensure the end results of the BPC work products are compatible with their systems for their users.

And I am going so far as to call on Public Services and Procurement Canada (PSPC) to take the lead and become that governing authority in Canada to roll out the BPC specifications nationwide in a cross-Canada general purpose interoperability framework implementation. Embrace the BPC work products and evangelize their use across all industry sectors. Establish the country’s BDXL DNS server, publish the required certificates, and be that authority to manage the onboarding of Canadian participants in support of industry and of governments at all levels: one nationwide decentralized, open, standards-based, secure, and robust platform for all forms of applications such as procurement, banking, health care, transportation, jurisprudence, and many others.

Let us catch up with what our overseas trading partners are already doing within their borders, and do it here and in the US.

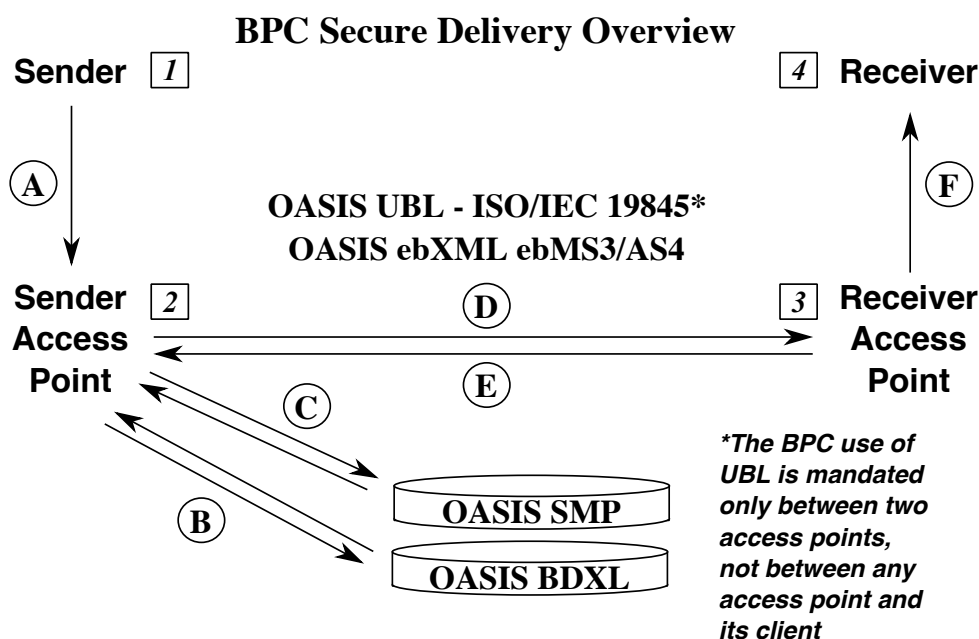
A. Technical deep-dive into the standards

A.1. Standards used in the BPC implementation of the 4-corner model

A.1.1. Overview of the logical steps

In the following in-depth diagram, one can see the BPC use of three OASIS specifications in the implementation of the secure 4-corner model, with a fourth, OASIS UBL - ISO/IEC 19845, being used between access points for data representation:

Figure A.1. A single 4-corner transmission of a document



There are six steps in the transmission of a document from the sender to the receiver (in either direction: seller-to-buyer or buyer-to-seller, and for all other roles where any document of any type needs to be transmitted securely) indicated by the circled letters between the four corners indicated by the squared numbers:

- A. The sender sends his original message to his own access point. This relationship between the sender and the sender access point is private. As such, any protocol may be used for transmission and any data format may be used for information representation, as agreed upon in the private relationship.
- B. The sender access point now needs to learn the specific access point for the receiver identified by the sender as the intended endpoint for the document. The document has a type (e.g. order, invoice, waybill, etc.), and a context of use of the business process in which it is used (e.g. simple invoice, invoice for order, etc.), and based on the combination the receiver needs to indicate one, possibly from a number of different, access points. Querying the metadata location DNS service implementing the OASIS Business Document Metadata Location Version 1.0 specification [BDXL 1.0], the sender access point finds the URL of the receiver’s service metadata information. See Section A.1.2, “Service lookup using BDXL location and SMP publishing” for a detailed technical illustration of this process.
- C. The sender access point accesses the returned URL for information about the location and services of the receiver access point representing the receiver, expressed using OASIS Service Metadata Publishing (SMP) specification [SMP 1.0][SMP 2.0]. This gives the sender access point what it needs to know where and how to talk to the appropriate receiver access point representing the receiver for the given combination of document and process. See Section A.1.2, “Service lookup using BDXL location and SMP publishing” for a detailed technical illustration of this process. Note that the receiver’s access point identity must not be cached by the sender’s access point for future document transmissions; each and every transmission must query the SMP-stored identity of the receiver’s access point to ensure the receiver’s latest-in-real-time intentions are respected.
- D. The sender access point may have to translate the original message into the format agreed upon by all access points committing to the network service agreements. In the BPC project’s use of the 4-corner model, if the original message data format is not UBL, the sender access point translates the message into a schema-valid UBL document. In other uses of the 4-corner model, the document may already be in a format agreed upon by all participants, such as a schema-valid ISO 20022 message. The sender access point then accumulatively validates the document, compresses it, digitally signs it, encrypts it, and then sends the result to the receiver access point. The BPC specifies the use of the AS4 profile of the OASIS ebXML ebMS3 specification [ebMS3/AS4] for the electronic message interchange.
- E. The receiver access point receives the message from the sender access point and must decrypt it, verify the sender’s signature on it, decompress it, validate it, and then send a confirmation back to the sender access point. The sender access point now has the reassurance the message has been received by the receiver access point.
- F. If the receiver does not understand the document format, in this case the BPC project use of UBL, the receiver’s access point must translate the received message into the format that has been agreed upon with the receiver and forward it. This relationship between the receiver access point and the receiver is private. As such, any data format may be used for information representation and any protocol may be used for transmission, as agreed upon in the private relationship.

All of the workflows implementing the choreographies of business transaction scenarios are built on top of this model for sending a single document from the sending party to the receiving party.

There are zero dependencies on the content of the document payload, and so, in fact, any payload with any payload format can be used in the 4-corner model. Endpoint, document type, and business process identifiers may be carried within the payload or supplied outside of the payload. This bodes well for the BPC network to support future non-invoicing and non-procurement applications as a nationwide secure delivery infrastructure. The CEF eDelivery wiki page[CEF eDelivery] chronicles many different domains using their implementation of these specifications in a 4-corner model for a wide range of document types and business processes.

A.1.2. Service lookup using BDXL location and SMP publishing

Understanding the following details is not necessary to understanding the objectives enumerated in Section A.1.1, “Overview of the logical steps”, but some readers of my other essays where I describe this process inevitably ask me to see these details to believe how well it works. I hope including this detail is helpful to them. Please skip this section if you are reviewing this document only from a high-level perspective.

For those readers interested in the technical detail of using BDXL and SMP, and with the kind generosity of Levine Naidoo of LXN Digital <http://lxndigital.com> for permission to use a live demonstration implementation of these services, the following illustrates in overview the steps involved in a sender access point determining to which of the receiver’s access points (as there may be many to select one from) a document is sent.

Critical to the success of these processes is the use of the robust and familiar worldwide Domain Name System (DNS) used by everyone on the Internet. Some governing authority implementing these BDXL and SMP specifications for a community of users will need to establish the endpoint, document type, and business process identity composition rules. Also, the governing authority must reify the single central domain of the community’s DNS records as a centralized DNS server properly connected to the Internet. In support of the BDXL services, the governing authority must authorize and manage the endpoint identities of all of the permitted participants and their associated SMP locations.

Participants in the community will need to contract the supply of, or reify themselves a domain or IP address for, an SMP service in which a recipient’s service metadata can be obtained by a sender’s access point.

Note

This particular demonstration is not an illustration of the actual BPC governance implementing these specifications, as these details have yet to be finalized. Working with bogus non-production information, this illustration is using both a DNS server and an SMP publisher implemented by LXN Digital at the time of writing. The demonstration infrastructure may change or disappear at any time, as it is a diagnostic testing environment. These steps follow early draft specifications supporting the Australian community of users, showing in principle what will be formalized in the final BPC specifications.

Demonstration scenario assumptions:

- In this example, the sender of the document has targeted LXN Digital as the recipient, whose Australian Business Number (ABN) is 15613331838. The ISO 6523 International Code Designator for the ABN scheme is “0151”. Accordingly, the governance prescribes the UBL party identifier element to appear in the document as follows:
 - `<cbc:EndpointID schemeID="0151" schemeAgencyID="ABN">15613331838</cbc:EndpointID>`
- The document type is an invoice.
- The business process is “simple invoice” in which the invoice being used is one that does not require a triggering purchase order.
- The transport protocol is ebMS 3.0 AS4
- The community DNS server is found at <http://dcl.dcafonline.com>

Overview step B - sender’s access point finding where all of the services available for an intended recipient are located

- i. Obtain either from the document or from the sender the endpoint identifier for the recipient
- ii. The governance allows recipients to be identified by their ABN. The governance prescribes the endpoint identifier to be composed following an OASIS party identifier specification[ebCore Party Id] that produces this for LXN Digital:

```
urn:oasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838
```

- iii The endpoint identifier is digested into a simple hash string:

```
$ md5 -s "urn:oasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838"
MD5 ("urn:oasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838")
= 6b6831d4ccd24d9b4617a5b1daacdd03
$
```

- iv The DNS Name Authority Pointer (NAPTR) record is queried using a subdomain composed of the string
“b-” followed by the hashed endpoint identifier, producing “question” and “answer” sections in reply:

```
$ dig -t naptr b-6b6831d4ccd24d9b4617a5b1daacdd03.dcl.dcafonline.com
...
;; QUESTION SECTION:
b-6b6831d4ccd24d9b4617a5b1daacdd03.dcl.dcafonline.com. IN NAPTR

;; ANSWER SECTION:
b-6b6831d4ccd24d9b4617a5b1daacdd03.dcl.dcafonline.com. 299 IN NAPTR
100 10 "u" "Meta:SMP" "!^.*$!https://dcp.dcafonline.com!" .
...
$
```

... in which the address of the SMP publisher is found to be <https://dcp.dcafonline.com>

Overview step C - sender access point finding the particular receiver access point the recipient wishes to use

- i. The SMP records are searched for the intended recipient’s group of service metadata reference pointers found for the recipient at <http://dcp.dcafonline.com/urn:oasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838>

```
<bdxr:ServiceGroup
  xmlns:bdxr="http://docs.oasis-open.org/bdxr/ns/SMP/2016/05"
  xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
  <bdxr:ParticipantIdentifier
    scheme="urn:oasis:names:tc:ebcore:partyid-type:iso6523:0151"
    >15613331838</bdxr:ParticipantIdentifier>
  <bdxr:ServiceMetadataReferenceCollection>
    <bdxr:ServiceMetadataReference href="http://... [http://dcp.openmsh.com/urn%3Aoasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838]">
    <bdxr:ServiceMetadataReference href="http://... [http://dcp.openmsh.com/urn%3Aoasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838]">
    <bdxr:ServiceMetadataReference href="http://... [http://dcp.openmsh.com/urn%3Aoasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838]">
    <bdxr:ServiceMetadataReference href="http://... [http://dcp.openmsh.com/urn%3Aoasis:names:tc:ebcore:partyid-type:iso6523:0151::15613331838]">
  </bdxr:ServiceMetadataReferenceCollection>
</bdxr:ServiceGroup>
```

- ii. Each of the reference pointers (abbreviated above and clickable; each URI is about 350 characters long) is dereferenced into the URI at which a set of service metadata values is found
- iii The sender access point searches each digitally-signed set of service metadata for the declared handling of the document type “invoice” for the “simple invoice” process currently in play
- iv Each combination of document and process specifies the transport endpoint URI address, the profile of the document exchange protocol, and the certificate along the lines of:

```
<bdxr:DocumentIdentifier scheme="dbc-docid"
  >urn:gov.org:docs:invoice<bdxr:ProcessList>
  <bdxr:Process>
    <bdxr:ProcessIdentifier scheme="dbc-procid"
      >urn:gov.org:procs:simple-invoice</bdxr:ProcessIdentifier>
    <bdxr:ServiceEndpointList>
      <bdxr:Endpoint transportProfile="busdox-transport-ebms3-as4">
        <bdxr:EndpointURI
          >https://ap.link4.cloud:7964/as4/HttpReceiver</bdxr:EndpointURI>
        <bdxr:RequireBusinessLevelSignature
          >false</bdxr:RequireBusinessLevelSignature>
        <bdxr:MinimumAuthenticationLevel/>
        <bdxr:Certificate>
          MIIFdDC...xO28QOG8= </bdxr:Certificate>
        ...
      </bdxr:Endpoint>
    </bdxr:ServiceEndpointList>
  </bdxr:Process>
</bdxr:ProcessList>
```

There is a listening AS4 handler waiting at the above URI.

- v. The sender access point now knows the precise details of how to interact with whichever receiver access point the recipient wants to be used for the particular combination of document type and business process, thus giving the receiver full flexibility to specify many possible access points, each suited for a particular purpose or value-added services

A.1.3. UBL - a common XML vocabulary for procurement and transportation

As mentioned earlier to be true for the CEF eDelivery project, the BPC interoperability framework infrastructure also securely and reliably exchanges any document of any format for any domain. If the sender and the receiver have already agreed on the format of the documents to be interchanged, the access points can use the transport layer as it is without content interpretation or transliteration.

However, an important objective of the BPC is the bridge the independence of diverse procurement systems. I’ve shown this cannot be done with the sender and receiver exchanging the documents directly. Taking on the responsibility for content translation, the BPC supports procurement by mandating that there be one, and only one, document format used between access points to convey the content of procurement documents and, in the future, transportation/logistics documents.

But which document format to use?

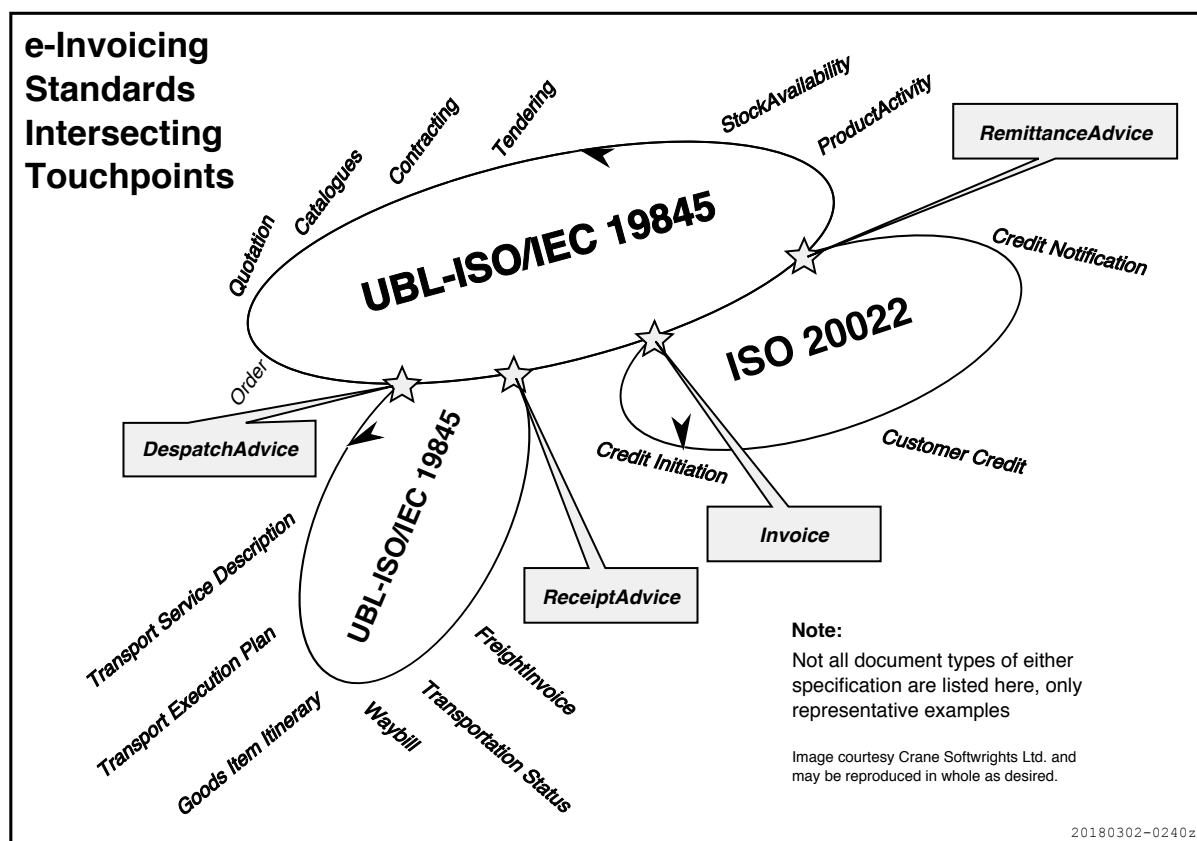
In 2001 the vendor-independent OASIS UBL Technical Committee[UBL TC] created the Universal Business Language (UBL), internationally standardized as ISO/IEC 19845[UBL 2.1 - ISO/IEC 19845]. It has been adopted widely[Wiki UBL], including by the PEPPOL project. The technical committee has been growing and maintaining the two normative components of this specification: a semantic library of business objects for procurement and transportation, and a set of XML schemas for the serialization of those business objects. Additional non-normative serializations of the semantic library have been published for JSON (object) and for ASN.1 (binary) serializations. As of this writing, UBL version 2.3 is in development. Interestingly, the committee guarantees full backward compatibility among minor versions of the specification. For example, all schema-valid instances of UBL 2.1 are, automatically, schema-valid instances of UBL 2.2 and beyond.

BPC network access points convert procurement documents from the private format they have agreed upon with their clients into UBL for transmission and out of UBL after reception. The actual sender procurement document *per se* does not get into the hands of the recipient. The information from the sender procurement document does get into the hands of the recipient in the format the recipient dictates to the recipient’s access point. This approach has proven very successful in the PEPPOL deployment.

UBL is a very large business vocabulary, and communities of users are expected to specify their subsets of the large vocabulary that make sense for the members of the community to use. Accordingly, the BPC e-Invoicing semantics committee is specifying that subset of UBL to be agreed upon between all access points. And it is this effort that requires the active participation of those who have a vested interest in conveying procurement information on the network. General accounting principles are followed, but vendors and users alike have procurement requirements they need to be resolved in the content of documents such as purchase orders and invoices. ERP vendors and users must be active at the BPC table to ensure their information is represented in the selection from the UBL vocabulary.

But procurement and transportation documents do not exist in a vacuum. Procurement involves payment, and the ISO 20022 is widely supported in banking circles. These two standards are well suited to co-exist and work together as shown in this diagram.

Figure A.2. Touchpoints within and between ISO/IEC 19845 and ISO 20022



The two standards ISO 20022 and ISO/IEC 19845 intersect in providing touchpoint document formats for procurement, transportation and payments. In the diagram, note the circular depiction of the phases of procurement identified earlier including pre-award (selecting), post-award (buying), followed by replenishment (assessing) that leads back to the next cycle. Representative UBL document types from each phase are shown (though not all of the 81 available document types in UBL 2.2 are itemized). In this diagram one can see from the highlighted call-outs how from within that procurement cycle the DespatchAdvice document bridges the transportation/logistics world until the ReceiptAdvice document indicates the goods have been received. Also shown is how the Invoice document bridges the payments world until the RemittanceAdvice document informs of the payment.

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[BDXR TC] OASIS Business Document Exchange (BDXR) Technical Committee <https://www.oasis-open.org/committees/bdxc/>

[BPC] Business Payments Coalition <https://fedpaymentsimprovement.org/payments-efficiency/business-payments-coalition/>

[Canada] Centralized procurement in Ontario <https://www.newswire.ca/news-releases/government-of-canada-awards-contract-for-electronic-procurement-solution-687404271.html>

[CEF eDelivery] eDelivery - Exchange data and documents securely and reliably <https://ec.europa.eu/cedigital/wiki/display/CEFDIGITAL/eDelivery>

- [CEF Open Source] CEF eDelivery open source and commercial solutions <https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/Access+Point+software>
- [ebMS3/AS4] OASIS ebXML Messaging Services Version 3.0 AS4 Conformance Profile https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=ebxml-msg#technical
- [eInvoicing charter] e-Invoicing group charter <https://fedpaymentsimprovement.org/payments-efficiency/b2b-payments/electronic-invoicing/>
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- [Open Marketplaces] G. Ken Holman <https://www.linkedin.com/pulse/open-specifications-marketplaces-ken-holman>
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- [PEPPOL Open Source] PEPPOL open source and commercial solutions <https://peppol.eu/downloads/peppolimplementations/>
- [Prompt Payment] US Department of the Treasury Prompt Payment Act https://www.fiscal.treasury.gov/fsservices/gov/pmt/promptPayment/promptPayment_home.htm
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[UBL Canadian Standard] OASIS Universal Business Language (UBL) Payments and Finance Subcommittee https://store.csagroup.org/ccrz__ProductDetails?sku=2704106 See the links in [UBL 2.1 - ISO/IEC 19845] for cost-free copies of the specifications.

[UBL TC] OASIS Universal Business Language (UBL) Technical Committee <https://www.oasis-open.org/committees/ubl/2001>

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