Interoperability

History and Lessons for B2B Networks

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Defining Interoperability

- There is no perfect definition
- For our purposes in B2B, let's go with:
- "The ability to render useful data and other information across systems, applications, or components"
  - We can also add companies, developers and development platforms to that list

Interoperability has four broad layers

Technological	• Hardware and software • Ex.: Train track gauge
Data	• Linked to technology; data must be readable and useable • Ex.: Documents exchanged in email
Human	• More abstract, consider language as the ultimate example
Institutional	• Legal systems, IP, contract law, rights • Note that systems do not need to be identical

Note that none of the last three layers is binary, all are shades of grey

Interoperability does not mean “sameness”

- To be interoperable means to be able to work together, *not to be identical*
- Consider almost all examples
  - Train systems share rail width, but not car, cargo and speed types
  - Currencies differ, but we can exchange them (with some expense!)
  - Cell phone networks can share voice, yet are not identical
  - Bank ATMs work together to allow us to get our money, but have different interfaces and capabilities

  - Interoperability is not about “yes” or “no”
  - It is about getting the elements that need to work together right, while letting systems continue to differentiate
    - APIs are a great example
    - They allow us to more easily share data, but innovate on top of this data

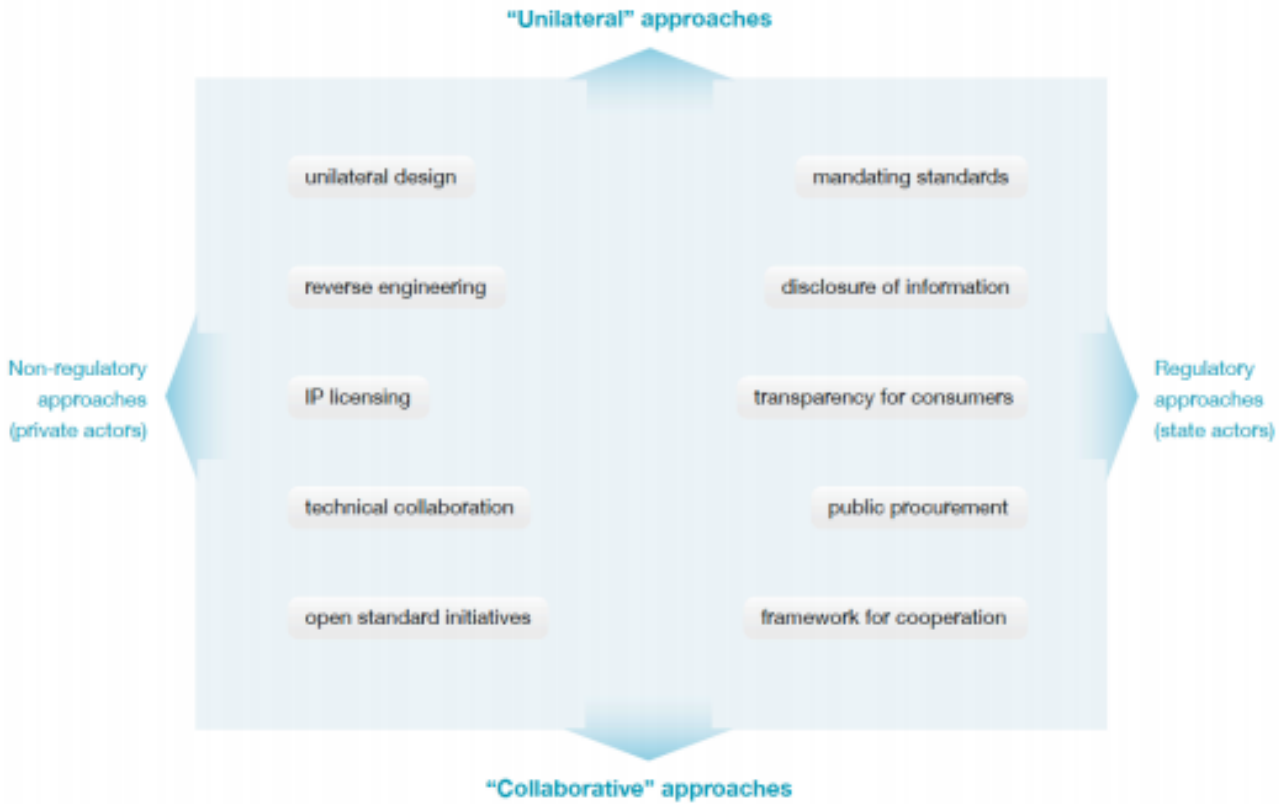
Interoperability can be “good” and “bad”

- The good news is that interoperability can:
  - Bring benefits and efficiency to end customers
  - Help them avoid lock-in and so grow markets
  - Support innovation

- The bad news is that interoperability can also:
  - Bring down whole systems (e.g., viruses, economic meltdowns)
  - Done wrong, interoperability can stifle innovation and lead to lock-in

How does interoperability come about?

- In a variety of ways based on two dimensions
  - –Unilateral
  - –Collaborative
  - –Regulatory and non-regulatory



Source: **Interop: The Promise and Perils of Highly Interconnected Systems** *Hardcover – June 5, 2012 by John Palfrey (Author), Urs Gasser (Author)*

So many interoperability case studies, so little time

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Physical	Logistics	Financial	Workplace PC
• Trains • Currency • Diesel Gas Nozzles • Electricity	• UPC/Barcode • Pallets • Shipping containers • EDI	• Credit cards • ACH • Bank ATMs • EMV Chip and Pin	• Office Docs • Mac and PC • Email • Calendar • Search Engine

Enterprise SW	Home Entertainment	Telecom
• ERP • ID Mgmt • API • PAAS	• E-readers • MP3 players • Game consoles • Social networks • TV networks • IM	• Land lines • Cell Networks • USB chargers • Fax machines

Interoperability Examples - Physical

Example	Date	Narrative	Gov't	Cost/Adapters
Trains	1800s	• Began in UK, Royal Commission chose gauge of largest railway; made its way around world since most eqpt. was designed in UK • US Congress asked for Transcontinental RR (Western half privately funded, Eastern paid by government)	Initally, then market-driven	Some "adapters" in South
Currency	Forever	• Occasionally fixed by governments, but often now allowed to float freely	Spotty now	Yes, small fees to exchange—1% or less. Rip-offs still occur.
Diesel Gas Nozzles	?	• Diesel gas nozzles differ in diameter from regular • Voluntary, but widely, not universally, adopted	No	Done to avoid misuse/damage
Electricity	1890s and beyond	• First battle of AC versus DC, AC won out due to economics • Europe different than US due to different companies, two voltages • But 12 different plugs around the world still	No	Cheap adapters available for travel

Interoperability Examples -Logistics

Example	Date	Narrative	Gov't	Cost/Adapters
UPC/Barcode	1970s	• Idea created in 60s, but scanners were too expensive • Retailers and manufacturers formed trade groups and wrestled over the standard • Retail trade group and McKinsey issued RFP; IBM won • Very slow initial adoption; nutrition labeling laws helped • Coercion of retailers helped • Scanner technology, EDI and Walmart added impetus (esp. EDI) • Risk of lock-in	No, retail drivers	• Fairly easy to print and stick on • Cost from GS1 reasonable (non-profit owned by retailers and mfrs.)
Pallets	1940s	• 1920s start, popularized 1940s WWII • Stringer versus block pallets • And at least six recognized sizes to this day, no complete standardization	No, just standards bodies with multiple standards	• Forklifts just maneuver around, lift differently
Shipping containers	1960s	• Designed by Malcom Maclean, licensed free to ISO (though Malcom had built a shipping company to take advantage) • Destroyed cartels and revolutionized shipping • But did not do so in Mediteranean—lack of investment, industry structure	• No, standard only • Voluntary, widespread, but not uniform adoption	• Drove out tons of cost from system
EDI	1960s	• First used for shipping manifests, same inventor as Berlin airdrop coordinator in WWII • First point to point, proprietary • Then TDCC had three requirements: eqpt. agnostic, flexible, any speed of transmission, fixed format not how message was sent • Then auto industry adopted, but not standard (1970s) • ANSI stepped in as suppliers complained about lack of standards (1982) • Grocery industry slow to adopt until mid 1980s, ANSI and UCC politics • US Standard not same as Europe (EDIFACT) • 1987 Walmart abandons proprietary EDI with P&G experiment • No single flavor of XML, some lock in	• Not really	• Still incompatibility • Still lots of mapping, system allows flexibility • SPS Commerce is an entire business borne of this friction

Interoperability Examples - Financial

Example	Date	Narrative	Gov't	Cost/Adapters
Credit Card Networks	1950s	• Interoperable at merchant level through government intervention, but otherwise not interoperable • BofA program became Visa to operate outside of CA • Competing Eastern banks became MasterCard	Lots, especially as fees went up	• Acquirers make 40 bps • Not all merchants take all cards, even if they have eqpt
ACH Network	1960s-1970s	• MICR system on checks was ABA, then local ACH networks sent just MICR, using local Feds • Feds ran national system and started its use by making payments to individuals that way • Over time, local groups formed NACHA through help of ABA, NACHA and Feds took almost 8 years to nationalize • There is a private operator NYCH/EPN which does 50% of commercial volumes and is owned by 20 banks	Federal Reserve Involved	• Expensive system, but no fees discounted on check by Fed rule!
Bank ATMs	1970s	• Citi started on its own network • Six banks (NYCE) responded • Visa and MasterCard started their own • Citi eventually joined NYCE	No	Some banks charge fees, some reimburse some or all customers
EMV Chip and Pin Cards	1990s	• Began in UK, with government study and concentrated banking industry • French chip experiment • Europay, MasterCard, Visa agreed (hence the name EMV)	Pressure, no laws	Retail acceptance

Interoperability Examples-PC/Workplace

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Example	Date	Narrative	Gov't	Cost/Adapters
Microsoft Office Docs	1980s on	• Originally not very compatible (Wordperfect)	Pressure, no laws	• Still not perfect, try google docs and MSFT docs!
Mac and PC	1980s on	• Initially none • Then some software developers chose to write for both platforms • Eventually Mac made a version that ran Windows	User pressure	• Still a pain in the ass sometimes
Calendar Apps	1998-2009	• First standard proposed by IETF in 1998 • Revised and widely adopted, not universally by 2009	IETF was spun out of gov't	• Still some glitches, Outlook versus Google, vs. Apple
Email	1980	• Compatible standards in place • Consumers must have some technical knowledge to make work	IETF was spun out of gov't	• No cost, some time/frustration
ERP	1990s	• No base level compatibility • Entire industry of middleware to facilitate exchange • Changing due to client pressure to avoid lock-in	No	• Traditionally lots of costs, middleware, adapters, mapping • Lessening
Search Engines	1990s	• Not compatible • Some meta search engines, but Google dominates	No	• Just a little time to re-run
Identity Management	2000s	• API identity sharing for consumers • SAML 2.0 starting to be adopted	No	• Very easy in consumer, painful in enterprise
API	2000s	• Several standards (moving to rest) • Consumer/customer driven	No	• Relatively small
Cloud Platforms (PAAS/IASS)	2000s	• Largely separate platforms right now • Starting to see tools and standards to manage across platforms	Not yet, some standards	• Will be fun to watch

Interoperability Examples-Home Entertainment

Example	Date	Narrative	Gov't	Cost/Adapters
E-readers	2000s	• Kindle book format incompatible, but app available on other devices • Epub starting to be widely adopted against Amazon which does not support	Only on prices	Two standards and app available, so not too much pressure
Itunes	2000s	• Very limited compatibility. Eventually added Windows support, but only for their equipment (spotty) • Format not compaible, sharing limited • No itunes support for other phones since iphone	No	Fairly prototypical closed system Some complicated ways around
Social Networks	2000s	• Easy to add in, easy to share credentials, not easy to leave • Open Social API gaining traction, but Google was slow to adopt, Facebook is a laggard with much to lose	No	Share credentials, contacts in, hard to leave
TV Networks	1950s	• Shows are recorded in compatible formats, but networks do not share content, except in re-run form • Formats do differ between countries	No	Adapters necessary or incompatible formats
Video Game consoles		• Games may be on different platforms because developers port them, but they are not interoperable	No	Need to buy multiple consoles and games
IM	1990s	• Attempts for unified protocol have failed, Msft, Yahoo, Aol use their own. • Reuters built one that interoperates, msft and yahoo as well, some EIM interoperation • Some have tried to build multi-compatible for consumers, but networks resist	No	Most people still just multi-home and ask other to so as well. Very easy and free to use multiple systems.

Interoperability Examples-Telecom

Example	Date	Narrative	Gov't	Cost/Adapters
Universal Charger/USB 2.0	2009	• Under threat from EC, 10 mfrs agreed to voluntarily use the micro-USB port • GSMA and ITU later • Korea tried two different standards of their own and belatedly went in line with rest of the world • Not at all clear US has adopted	Yes, threat started the ball rolling in EU	• Most settled on USB Micro • Apple provided a converter!
Telephone Networks	1900s	• Was a monopoly • Telecom Act of 1934 set the rules and prices for interoperability	Yes, completely regulated	• Eventually non-Bell equipment was allowed, now interconnection fees buried in rates
Cellular networks	1990s	• Most of the world is GSM, most of US is CDMA • GSM was a Euro standard adopted by law in 1987 • Qualcomm, as US company is behind CDMA	Euro yes, US less so, but interconnect yes	• SIM cards • Changing phone • Or paying outrageous fees • All happen
Fax machines	Late 60s+	• Commercialized in 1970s • Several standards leveraging telecom committees from 1968 on, by 1980 ITU/NTT join in and Asia is on board	Stds orgs from Telecom world	• Initial issues between Europe and US, gone by early 1980s

Lessons from these examples for B2B Networks

- Don’t wait for the government, especially in the US!
- Standards bodies can help and so can sticking with standards
- Interoperability comes about through the concerted action of private players
  - Often there is a leader, and/or enemy resisting
    - Think Citi in ATMs
- Interoperability can take a long time to come about, but the long arc is towards interoperability as suppliers demand it and so do consumers
  - EDI, Barcodes, etc.
- Get interoperability right, do what is necessary to work smoothly, but do not constrain innovation
  - EDI probably did not have quite enough standardization on docs
  - ACH was too tight on allowances
- Big players typically resist for as long as possible, then come around
- Small guys often want to free-ride
- Need the folks in the middle to band together

Thank you

Much of this material originated in:

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