Cloud Deployment and Testing of Internet Data Submission Applications

THE VALUE OF PERFORMANCE
NORTHROP GRUMMAN

4 March 2015

Doug Smith NGIS Technical Fellow

Applications



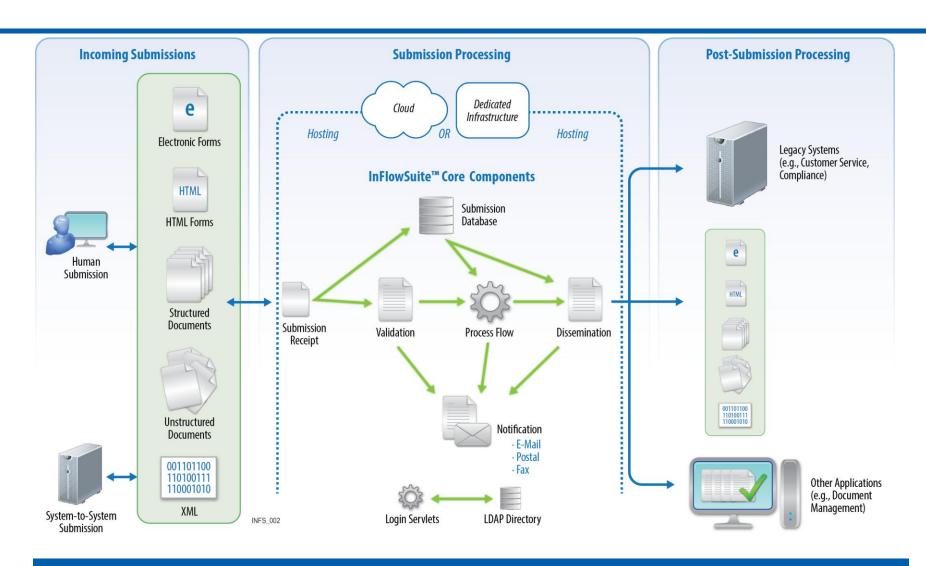
- Filing Information Returns Electronically (FIRE)
 - Submission of tax information returns mostly data about payments made by financial institutions (Forms 1042-S, 1097, 1098, 1099, 3921, 3922, 5498, 8027, 8955-SSA, and W-2G)
 - Flat files, fixed-length records
 - Peak loads at filing deadlines
 - Personally Identifiable Information (PII)
- Affordable Care Act (ACA) Information Returns (AIR)
 - Submission of information returns by Insurers, Employers, and Exchanges (Forms 8963, 1094-B, 1095-A, 1095-B, 1095-C)
 - XML format with dynamic repeating elements
 - Volumes TBD
 - Personally Identifiable Information (PII)

EAVERS man, tree obline, 28 mile	on no se Epilopees Set Sys	CORRECT CONTRACTOR CON	2012	Maritania Fronties, Ann. Ampliles, Maritani pi Podis		
611 S. Ramas Ave. suite 180 TOPES, EASEAS 48401-1820 1-848-275-5727 H-004505		19,466.54	ZUIZ tota fac. 345			
		in terms	Jan Dankon	Over 8		
48-0944170	353-35-5003	7 Dertal pain States of B role (s)	Pearl Securior Villada 202,79	Recipient Federal Leture		
BACESSYT mans, over all and 3P code	es de mes	Timpton marketing a produce produce 499.5	o Not unrealized approximates in supplyants more time	If this form shows Federal Income tax		
L NETUREÉ 1234 FIRST STRO		7 Sentence Cops T	Service Service	withheld to fine 4 actach this		
ANYBOWN, KIS	XXXX	In Your periodical of condition (see)	Pri Tolu majkerus noortholosa	copy to MAG Setun		
SRXXXXXXXXX	NXX	BESTET ONE	97-83 STMENT 18,771.28 0 (20)101 9,572.21			

Save As	Blank	Form 8963	Form	8963 Instructions	Clear	All Form	Fields	Print Fo
								Pag
8963	3	F	Report	of Health	Insura	nce		OMB Num 1545-22
(January 2014) Department of the	Treasury	Informatio	on about Form 8		uctions is at ww		formetitet.t.	Publicly Av
Internal Revenue		R	ead the instru	uctions before you	complete For	m 8963		Informat
Check only o	ne box belo	w(see instruction	18)			□ C	orrected re	port (see instruction
Single-perso	n covered er	rtity: E	esignated er	ntity:				
1 Sing	le-person cov	ered entity		t of an affiliated group	p			
			2b Other					
Employer ide	entification n	umber (EIN)	Number	of controlled group m	embers includ	fed in	Reporting	year
			Schedule	A (see instructions)				
53-0017929								2014
Entity name								
Wand								
Entity name (d	continued)							
		6 Mars bear	D O D	. In the section of				
123 mAIN ST	iper and stree	t). If you have a	P.O. BOX, Sec	s instructions.				
Address (cont	in and							
Address (cont	inued)							
YOCITY							AL	▼ 20934
Foreign count		of Official Sig	ning on Ret		ncelstate/cour		Foreign po	
PART I	Signature			Foreign provi	Person Cov	ered E	ntity or D	esignated Entit
PART I	Signature (Agent of a applicable) of pequy, I de and complete.	n Affiliated G	xamined this re	nalf of the Single-	Person Cov ntity) and Co	ered E	ntity or De by the De	esignated Entit esignated Entit f my knowledge and
PART I Under penalties is true, correct, authorized to sign (if you checked instructions). I uf fee to the IRS of declare that each member of the immember of	Signature (Agent of a applicable) is of perjury, I de and complete. On the complete of the complete of the complete of the controlled group. CA section 90°	clare that I have e further certify that behalf of that on also declare that the designated er controlled group. I controlled group is other to overed	roup, or Oth samined this re t I am an officer vered entity. he above name fitty will receive Each entity that entitled on this entity as of the	half of the Single- her Designated Er	Person Coverity) and Countity) and Countity) and Countity) and countity or an affiliated group is their and fire desired group in the fire group in the group in the fire group in the group in th	ered E onsent hts, and, the desig up or oth impose jointly an signated is jointly	ntity or Do by the De to the best or pnated entity, er designate d by ACA set of severally if entity indicat and several	esignated Entit esignated Entit f my knowledge and and that I am duly d entity (as per the ction 9010 and is to able for this fee. I fu ted on this report. E; ly liable for any app
PART I Under penalties is true, correct, authorized to si [if you checked instructions]. I u fee to the IRS oo declare that each member of the penalty under A penalty under A.	Signature (Agent of a applicable) is of perjury, I de and complete. On the complete of the complete of the complete of the controlled group. CA section 90°	clare that I have e if further certify that in behalf of that or also declare that to the designated er- controlled group, is or that is a covered to. (If the designat	roup, or Oth samined this re t I am an officer vered entity. he above name fitty will receive Each entity that entitled on this entity as of the	port, including accompleted Eiliport, including a member of the consents to the end of the day on Decided by the IRS, each excluding according to the IRS, each excluding a manufacture of the end of the day on Decided by the IRS, each excluding a manufacture of the end of the day on Decided by the IRS, each excluding a manufacture of the end of the day on Decided by the IRS, each excluding a manufacture of the end of the day on Decided by the IRS, each excluding a manufacture of the end of the day on Decided by the IRS, each excluding a manufacture of the end	Person Coverity) and Countity) and Countity) and Countity) and countity or an affiliated group is their and fire desired group in the fire group in the group in the fire group in the group in th	ered E onsent his, and, the design up or oth imposer jointly ar- signated is jointly ort is dee	ntity or Do by the De to the best or pnated entity, er designate d by ACA set of severally if entity indicat and several	esignated Entit esignated Entit f my knowledge and and that I am duly d entity (as per the ction 9010 and is to able for this fee. I fu ted on this report. E; ly liable for any app
PART I Under penalties is true, correct, authorized to sis [if you checked instructions], I use fee to the IRS of declare that cellular the penalty under Adesignated erits Sign	Signature (Agent of a applicable) of perjuny, I de and complete, go this report o box 2a or 2bj. I inderstand that in behalf of the the entity in the controlled group CA section 90' ty.)	clare that I have e if further certify that in behalf of that or also declare that to the designated er- controlled group, is or that is a covered to. (If the designat	roup, or Oth examined this re i am an officer vered entity, the above name stity will receive each entity that entity as of the ed entity is sele	half of the Single- her Designated Ei port, including accome of the single-person co- d critiq is the agent of IRS communications is as member of the con- report consents or person of the day on Dec- cided by the IRS, each	Person Cov ntity) and Co anying statement were dentity or: an affiliated group is trolled group is house of the de amber 31, 2013 entity in this repr	ered E onsent his, and, the desig up or oth impose jointly an signated is jointly and is deer number	ntity or Do by the De to the best or pnated entity, er designate d by ACA set of severally if entity indicat and several	esignated Entitlesignated Entitlesignated Entitlesignated Entitlesignated Entitlesignated Entitlesignated and that I am duly dentitly (as per the cloin 9010 and is to able for this fee. If the cloin of the entitlesignated on this repeat of the entitlesignated entitlesig
Under penalties is true, correct, authorized to significant instructions; [if you checked instructions], the ce to the IRS or declare that cellular the penalty under A designated entities. Sign Here	Signature (Agent of a applicable) applicable) of perjury. I de and complete, grant be and complete to box 2a or 2b) I understand that in behalf of the the entity in the controlled ground controlled ground (CA section 90° yr.) Signature of Printed name	an Affiliated G clane that I have e further confly tha n behalf of that or also declare had or the designated or controlled group, it the designated group is on that is a covered to that is a covered of official	roup, or Other examined this re it am an officer vered entity. he above name tity will receive each entity that entitied on this is entity as of the ed entity is sele	port, including accomport the single-person color of early is the agent of early is a member of the color of early is a member of the color of the day on Decorately the IRS of early is a color of the IRS of early is a member of the color of the IRS of early in the sign of the color of the IRS of early in the IRS of th	Person Cov ntity) and Co anying statement overed entity or an affiliated group is shaling to the fee strolled group is shaling to the de- tember 31, 2013 critiy in this repi	ered E onsent his, and, the desig up or oth impose jointly an signated is jointly and is deer number	ntity or Do by the De to the best or pnated entity, er designate d by ACA set of severally if entity indicat and several	esignated Entitlesignated Entitlesignated Entitlesignated Entitlesignated Entitlesignated Entitlesignated and that I am duly dentitly (as per the cloin 9010 and is to able for this fee. If the cloin of the entitlesignated on this repeat of the entitlesignated entitlesig
PART I Under penalties is true, correct, authorized to se [# you checked instructions] in instructions] in feet to the IRS of deciare that age member of the temperalty under 4 designated entit Sign Here	Signature (Agent of a applicable) of perjuny, I de applicable) of perjuny, I de applicable of perjuny, I de applicable of perjuny, I de applicable of post applicable	claim Affiliated G claims that I have e flurther certify tha n behalf of that or also declare that it the designated er the designated group i controlled group i controlled group i or that is a covered to (if the designat or official the of signing official contact Perso contact Perso	roup, or Other control of the contro	port, including accome of the single-person colored representation of the single-person consents to the report consents	Person Cov ntity) and Co anying statement overed entity or an affiliated group is shaling to the fee strolled group is shaling to the de- tember 31, 2013 critiy in this repi	ered E onsent his, and, the desig up or oth impose jointly an signated is jointly and is deer number	ntity or Do by the De to the best or pnated entity, er designate d by ACA set of severally if entity indicat and several	esignated Entit esignated Entit f my knowledge and and that I am duly d entity (as per the close 9010 and is to table for this for subject for this for ill jable for mis for graph entit to the choice of Business fax numb
PART I Under penalties is true, correct, authorized to sis [if you checked instructions]. I i fee to the IRS o member of the penalty under A cosignated entit Sign Here PART II Do you want to	Signature (Agent of a applicable) of perjuny I de and complete, and complete and complete in the second control of the controlled group control of the controlled group CA section 90° by.) Signature of Printed near	an Affiliated G clane that I have e further confly tha n behalf of that or also declare had or the designated or controlled group, it the designated group is on that is a covered to that is a covered of official	roup, or Other control of the contro	port, including accome of the single-person colored representation of the single-person consents to the report consents	Person Cov ntity) and Co anying statement overed entity or an affiliated group is shaling to the fee strolled group is shaling to the de- tember 31, 2013 critiy in this repi	ered E onsent his, and, the desig up or oth impose jointly an signated is jointly and is deer number	ntity or Do by the Do to the best or nated entity, er designate a by ACA sees d several in entity indicat and several med to cons	esignated Entitiesignated Entitiesignated Entitiesignated Entities and that I am duly dentity (as per the ction 9010 and is to take for this feet of the first for any appears to the choice of the ch
PART I Under penalties is true, correct, authorized to se [# you checked instructions] in instructions] in feet to the IRS of deciare that age member of the temperalty under 4 designated entit Sign Here	Signature (Agent of a applicable) of perjuny I de and complete, and complete and complete in the second control of the controlled group control of the controlled group CA section 90° by.) Signature of Printed near	claim Affiliated G claims that I have e flurther certify tha n behalf of that or also declare that it the designated er the designated group i controlled group i controlled group i or that is a covered to (if the designat or official the of signing official contact Perso contact Perso	roup, or Other control of the contro	port, including accome of the single-person colored representation of the single-person consents to the report consents	Person Cov ntity) and Co anying statement overed entity or an affiliated group is shaling to the fee strolled group is shaling to the de- tember 31, 2013 critiy in this repi	ered E onsent his, and, the desig up or oth impose jointly an signated is jointly and is deer number	ntity or Do by the Do to the best or nated entity, er designate a by ACA sees d several in entity indicat and several med to cons	esignated Entit esignated Entit f my knowledge and and that I am duly d entity (as per the close 9010 and is to table for this for subject for this for ill jable for mis for graph entit to the choice of Business fax numb
PART I Under penalties is true, correct, authorized to sis [if you checked instructions]. I i fee to the IRS o member of the penalty under A cosignated entit Sign Here PART II Do you want to	Signature (Agent of a applicable) of pepuy, I of a applicable) of pepuy, I of and complete gritter report to box 2a or 29 I anderstand that in behalf of the bit entity in the controlled groot professional professi	claim Affiliated G claims that I have e flurther certify tha n behalf of that or also declare that it the designated er the designated group i controlled group i controlled group i or that is a covered to (if the designat or official the of signing official contact Perso contact Perso	roup, or Other control of the contro	port, including accome of the single-person colored representation of the single-person consents to the report consents	Person Cov ntity) and Co anying statement overed entity or an affiliated group is shaling to the fee strolled group is shaling to the de- tember 31, 2013 critiy in this repi	ered E onsent his, and, the desig up or oth impose jointly an signated is jointly and is deer number	ntity or Do by the Do to the best or nated entity, er designate a by ACA sees d several in entity indicat and several med to cons	esignated Entiti fmy knowledge and Entit fmy knowledge and and that I am duly d entit is gar per the footbook of the state of the state of the state state of the state of the state of the state state of the state of the state of the state I state of the state of the state of the state Business fax numb U yes Yes
PART I Under penalties is true, correct, authorized to is free confect, authorized to is free in the HS or member of the member of the member of the member of the consignated entitle the consignated entitle the confect of the conf	Signature (Agent of a applicable) a policable) a control of applicable in a policable in a polic	an Affiliated G class that I have ex- It is the control of the to also declars that be designated or controlled group, or hat a so overed controlled group, or hat as a covered controlled group, or many or controlled group, or	varsined this re I am an officer I am an officer rend entity. The above name flight will receive grilly will receive all In Designee at this report with Send the forms if you' pame on each	port, including accome of the single-person colored representation of the single-person consents to the report consents	Person Cov nitry) and Cr anying statement versel entity or an affiliated gro stating to the feature of the stating to the stat	ered E properties and the design and the design and the design are designated as jointly are its designated and the designated are designated as jointly are its designated and the designated are designated as jointly in the designated and the designated are designated as jointly in the designated and the designated are designated as jointly in the designated are designated as jointly in the designated are designated as jointly in the designated as jointly in the designated are designated as jointly in the designated	ntity or Dr. by the De to the best or nated entity. er designate d by ACA see and several and several med to cons Designee p Designee fi staple, lear, entity sized p vely.	esignated Entit signated Entit finy knowledge and and that I am duly d entit (as per the colon 901) and that I am duly d entit (as per the colon 901) and is to colon 901) and is to colon 901 and is to finy fine I am july stable for any app july stable for any app did to the colon 901 Business fax numb Yes Transport or tage any of these ackages, entire your

InFlowSuite[™] Architecture



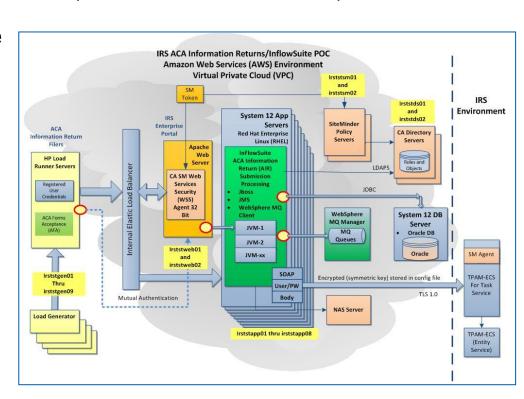


COTS for extremely high volume and highly complex submission processing

1099/1095 Proof of Concept Purpose



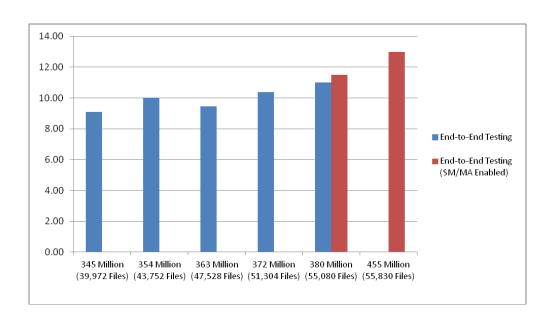
- Demonstrate ability to simultaneously process Tax and Healthcare Information Returns (1099-INT, 1099-B, 1095-B) at peak day volumes
- Expand validation to all Pub 1220 required fields for highest-volume FIRE/AMMPS Information Returns (1099-INT and 1099-B)
- Assess the ability to leverage FedRAMP Certified Amazon Web Services (AWS) Virtual Private Cloud (VPC) for IRS Development and Testing
- Measure impact of security controls (SiteMinder/Mutual Authentication)



1099/1095 Proof of Concept Performance Results



- FIRE + AIR 2017 Peak Day
 - 345M IRs in 40K files
 - 1099-B volume: 217,815,577
 - 1099-INT volume: 93,349,533
 - 1095-B volume: 34,680,000
 - File size range: 1 to 2.5M IRs/file
 - 50% small (< 1K)
 - 38% medium (1K 100K)
 - 12% large (> 100K)
 - Processed in 9 hours



- Linear scaling as volumes increased 3%, 6%, 9%, 12% beyond anticipated peak day
- Processed 2x FIRE actual peak day (455M) with security in 13 hours

Throughput scales linearly; easily handles very high volumes

AWS High Performance Application Testing



Lessons Learned

- For highest performance, iterative tuning is necessary
 - Parameter values differ from non-virtualized environments
 - Required modification of parameters associated with O/S Kernel, Directory (LDAP), Database, Application Server, and File storage
- "Pre-warming" Front-End Processer is required for high-volume tests
 - Elastic Load Balancer triggers automatic throttling (apparent Denial of Service attack) otherwise
- Very large file/LoadRunner SOA timeout issue
 - Timeout parameter for LoadRunner SOA has maximum value of 1 minute
 - Batch following 10 GB batch submitted successfully, but showed as error
 - Acknowledgement not sent within timeout due to file transfer
- Ephemeral storage is fastest option for temporary file storage
 - Faster than NAS, but does not persist once virtual instance is stopped

THE VALUE OF PERFORMANCE.

NORTHROP GRUMMAN