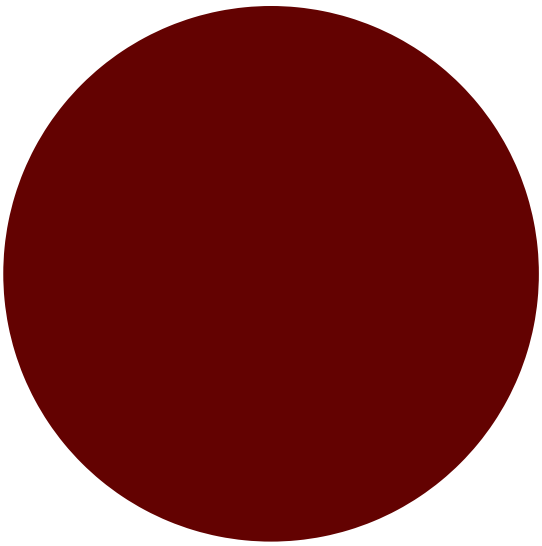

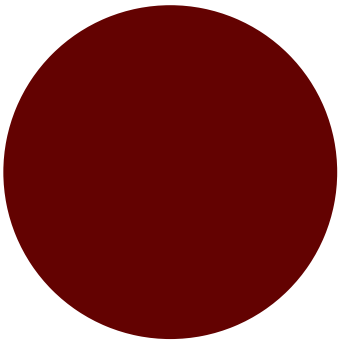

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DISCLAIMER:

This Report is intended to facilitate an open and informed consideration about the subject matter. This Report does not represent the official policy of the Federation of State Medical Board or any of its member board. The Federation of State Medical Board and its member are not bound by any conclusion or recommendation made in this Report and the Federation of State Medical Board reserves the right to rescind or reconsider the views in this Report as the subject matter continues to evolve.

EXECUTIVE SUMMARY

The Federation of State Medical Board (FSMB) is a national non-profit focused on providing support services to medical licensing boards throughout the United States and its territories. Among those services is the Federation Credential Verification Service (FCVS), an NCQA-certified credential verification platform that is widely used by physicians and physician assistants seeking medical licensure and credentialing. Efforts to improve this service and to ensure that current and best practice technologies fulfill strategies that the process seeks to create and verify medical credentials by both FCVS and the industry as a whole, do not utilize available technology to their full potential and require changes to meet the needs of the healthcare marketplace of the future.

This realization led the FSMB to undertake a series of activities, including the evaluation of existing and emerging technologies for their own credential verification platform, as well as increased engagement with a wide variety of stakeholders to discuss how best to collaborate to create not only individual, but systemic, changes that make the credentialing process more efficient, thus enhancing the partnership between actors for the betterment of the patient.

This paper reviews Digital Signatures, Open Badges and Blockchain technology and provides commentar

1. INTRODUCTION

Credential ser e an impor an role in ocial forma ion and main enance of ocial order. Credential ,

Within the United States, the Uniform Electronic Transaction Act (UETA) and the Electronic Signature in Global and National Commerce Act (ESIGN) establish legal and functional equivalence between paper-based transaction and digital transaction. Importantly, this combination of state and federal law governing electronic transaction does not specify that a specific technology is required for Electronic Signature. The law allows the parties in the transaction to mutually agree to the use of an method of authentication that is the need and criteria concern inherent to the particular transaction. The digital medium used does not affect the legal significance of the transaction.

THIRD PARTY STANDARDS WITHIN HEALTHCARE

credential or a recogni ed en v hich i able o erif he record of emplo men . B he la e 1990 , Join Commi ion andard req ired primar o rce eri ca ion for all licen ed independen prac ioner , a req iremen ha hor l e panded o incl de mo healhcare pro ider , incl ding n r e and o her a lia ed heal h profe ional . Primar o rce eri ca ion con rm ha an indi id al po e e a alid licen e, cer i ca ion, or regi ra ion o prac ice a profe ion v hen req ired b la or reg la ion. The Join Commi ion' Accredi a ion Man al de ne primar o rce eri ca ion a eri ca ion of an indi id al prac ioner' repor ed q ali ca ion b he original o rce or an appro ed agen of ha o rce. Me hod for cond c ing primar o rce eri ca ion of creden ial incl de direc corre pondence, doc men ed elephone eri ca ion, ec re elec ronic eri ca ion from he original q ali ca ion o rce, or repor from creden ial eri ca ion organi a ion (CVO) ha mee Join Commi ion req iremen .

. Sec re elec ronic eri ca ion from he original q ali ca ion o rce remain nde ned, b appl ing principle of elec ronical ran ac ion la , a creden ial prod ced in a digi al forma ho ld be accep able o long a he in egri of he digi al creden ial can eri ed. b i cri ical for he elemen al na re of r v hin heal hcare ha he rel ing in i ion can de ermine ha he creden ial i a hen ic, na ered, and ec re.

Similarl , NCQA andard oc on proced ral in egri and he abili o a hen ica e informa ion ha i e en ial o p blic afe . NCQA andard req ire an organi a ion o erif elemen ch a licen re hi or and DEA cer i ca ion a he ime creden ialing repor are repor ed o o a hird par . Accep able doc men a ion ha mee he andard incl de fa ed, digi al, elec ronic, canned, or pho ocopied

a hen ici of digi al doc men and ran ac ion commonplace in he commercial con e . Addre ing he r principle i e - he abili o r credenial a pre ehed - i a fo ndaional componen of

Digital Signatures with PKI do three things that are essential if their evidence will be found acceptable b

CERTIFICATE AUTHORITIES

endor of diploma and ran crip er ice ; imilarl o„ er PDF credential digiall igned v ih Adobe Bl e Ribbon ec ri . Credential pro ided hro gh he plaform are c rrenl recogni ed for licen ing deci ion b ae medical board .

SIGNATURE VERIFICATION

In he ca e of Doc Sign, eri ca ion i pro ided b ir e of Doc Sign ac ing a ho and Cer i ca e A hori for bo h par ie . Doc Sign no onl ac a a Cer i ca e A hori for heir c omer , b al o pro ide a Tr Ser ice Pro ider (TSP) Program for ho e c omer v hov an or are legall req ired o e a di„ eren Cer i ca e A hori . The TSP Program allov doc men o be igned ia he Doc Sign in erface ing ke pair generaed and managed b Cer i ca e A horiie o her han Doc Sign.

When he doc men forma of a digiall igned doc men i a PDF, eri ca ion m be comple ed ing Adobe oly are, a Adobe ov n he PDF andard. In ho e ca e , eri ca ion of a doc men i comple ed ing Adobe Acroba on he de kop or Adobe Li eC cle a par of an a oma ed proce on a er er. To erif he doc men , he de kop er open a PDF ing Adobe Reader or Adobe Acroba. When a doc men ha a alid igna re, a bl e ribbon in a bl e bar hov abo e he doc men in he Adobe iev er.

In addi ion o de kop eri ca ion of a PDF ing Digi al Signa re endor oly are, ome pro ider , like CeCredential Tr , al o pro ide dedica ed online credential look p por al for chool ha licen e heir eri ca ion er ice. Verif ing a credential on one of he e por al generall req ire kno v ing ome of he recipien ' per ohall -iden i able informa ion, for e ample, heir la name, da e of grad a ion, or he la fo r digi of heir ocial ec ri n mber.

CONCLUSION

Digi al Signa re mee legal and reg la or req iremen and are he mo e abli hed form of digi al credential a hi ime. Digi al Signa re v ill con in e o ha e a role o pla in impro ing he e cienc of he creden ialing proce in he near o mid-erm. Hov e er, e ploring addi ional de eloping echnologie e pand pon ba eline impro emen , a he ma o„ er abernai e for ho e en ibie looking o remake heir creden ialing and eri ca ion em for he longer erm.

2.2 OPEN BADGES

Open Badge refer o a echnical andard for b ndling informa ion abo an indi id al' achie emen , embedding i in o a por able image , le, and alida ing ha , le hro ghv eb-ba ed eri ca ion. Thi forma v a de igned o con e a ing lar kill or achie emen hro gh a eri able digi al image and ho ed e of da a.

Open Badge aro e in 2011 o mee he need of an increa ingl fragmen ed and informal ed ca ion and labor marke place. Adop ion ha been highe for micro-creden ialing, non-formal learning, and profe ional de elopmen e ca e . Ini ially pearheaded b he Mo illa Fo nda ion v ih a gran from he MacAr h r Fo nda ion, he Open Badge andard ha been main ained b he IMS Global Learning Con or i m ince Jan ar 1, 2017.

Open Badge are image le in SVG or PNG forma connec ed o a ho ed JSON da a e and I er Pro le. The peci ca ion al o allo v for badge o be cr p ographicall igned b he i er ing a Digi al Signa re (ee Sec ion 2.1); ho v e er, hi i ho req ired. In prac ice, mo i ing a horie do no ign badge . There i pec la ion ha hi omi ion i d e o he addi ional e or en ailed in managing and main aining he igning ke for alida ion. Wi h hi in mind, he remainder of hi Repor v ill refer e cl i el o ho ed b n igned badge nle o herw i e no ed.

Open Badge emplo a da a chemav ih req ired eld op imi ed for peci c ed ca ional e ca e , ch a de crip ion, • image, • and cri eria narra i e. • E en ion o Open Badge allo v for e panding hi imi ed da a e o incl de o her pe of da a ch a e , arra , rl, boolean, and more. E en ibili pro ide a grea deal of e ibili b doe req ire igni can coordina ion be v een par ie If he e en ion are in ended o be ed a a andard. An e ample of hi in medical creden ialingv o ld be andard form ed o erif re iden c raining.

The IMS Global Learning Con or i m ho a free, independen Open Badge 2.0 eri er a h p :// openbadge alida or.im global.org. IMS al o pro ide a proce b v hich endor ma be cer i ed for compliancev ih he Open Badge 2.0 andard. Cer i ca ion of endor m be rene v ed on an ann al ba i b pa ing he cer i ca ion proce and pa ing an ann al fee.

The Open Badge frame v ork relie on r ed in ab ion o i e, ho , and ec re badge for f re eri ca ion. While hi i acceptable in man i a ion , he reliance on a ingle, r ed o rce ma ca e i e If badge are lo or modi ed b ei her he i er or an a acker af er i ance of an Open Badge. Ho ing of badge p blicl al o remo e he op ion of oring en i e da a v ihin an Open Badge, a hi in forma ionv o ld be ie v able b he p blic.

OPEN BADGES USE CASES

A more appropria e for Open Badge recording profe ional achie emen , co r e comple ion, di inc ion a ard , profe ional kill de elopmen , and a ainmen of per onal goal . A repor f nded b he U.S. Depar men of Ed ca ion' Oce ce of Voca ional and Ad l Ed ca ion (OVAE) fo nd ha Open Badge ho par ic lar promi e for cer if ing he kill of ad l learner in ba ic ed ca ion program or v ho ha e ob ained peciali ed kill in niq e e ing ha do no crea e formal creden ial , ch a in he ca e of kill ob ained d ring he co r e of mili ar er ice.

CONCLUSION

BLOCKCERTS

The breakthrough promise of blockchain technology is the ability for individuals to directly own, share, and validate their digital assets. These digital assets may include money, like cryptocurrency, or other assets, like credentials. Credentials that may be owned and shared using blockchain technology include landable, intellectual property, will, insurance documentation, identity records, e.g., driver's licenses and passports, health records, verified resumes, employment verification, and academic credentials. Although legacy digital record formats like PDF and Digital Badge may be time stamped to a blockchain for later verification, the characteristics of the blockchain network have prompted the development of new record formats that take full advantage of the blockchain's unique ownership characteristics.

Blockcerts is a global open standard for blockchain records that employs many of the characteristics of Open Badge and PDF while enabling more certain and flexible digital ownership, parsing, sharing

DIFFERENCES BETWEEN BLOCKCERTS AND TRADITIONAL OPEN BADGES

Blockcer v a de eloped ba ed on he Open Badge peci ca ion for digi al record de cribed in Sec ion 1.2. Ho v e er, Blockcer make e eral change o he Open Badge peci ca ionv hich allo v i o be ed for he eri ca ion of av ider range of high- ake claim and pri a e da a.

Flexible Form Factor. A e ible doc men di pla i embedded in he Blockcer JSON le. Thi o„ er more e ibili han rel ing on a ingle, a ic image and al o allo v he record pe o gener e man pe of reliable di pla . Accordingl , Blockcer can be ea il ed o repre en an de igned form fac or ch a diploma ran cript profe ional cer i ca ion licen e and o her .

Display Integrity. The Blockcer code gener ing he creden ial di pla i cr p ographicall igned b he i er. Thi mean he in egri of he i al Blockcer di pla i al o eri ed d ring he eri ca ion proce . B con ra Open Badge e an image di pla o poin o he real creden ial,v hich i de ned a a ho ed JSON da a e . Thi epara e di pla and da a, allo ing for change o he di pla of he badge v ho a„ ec ing eri ca ion. For v ork o v ha need a reliabl h man-readable er ion of de igned creden ial , Blockcer are preferable.

Digital Signatures. While fe v Open Badge are digi all igned in prac ice, Blockcer are digi all igned b defa . Thi en re doc men in egri and i er a hen ici eri ca ion. Where badge are igned, i i he image ha i igned a oppo ed o he ho ed JSON da a e v hich hold he badge da a.

O ine Sharing and Verification. Signing Blockcer allo v for ongoing eri able di pla of record v he her he are ho ed or no . A Blockcer ma , of co r e, be ho ed for ea ier online haring ia a link. Ho v e er, if he ho ed er ion of he Blockcer i emo ed, he Blockcer can ill be ie v ed and eri ed ing onl he JSON le. Beca e he leor noCllf-2 (h- 533 BDC)-25.9 (ma)13 ( )38.9 (, of c)-2 (o3

ho ld erif v he her or no heir pro ider i f ll complian v ih open andard .Thi can be ea if checked b e ingv he her or no a blockchain creden ial i ed b he pro ider eri e in he Blockcer Uni er al Veri er a blockcer .org.

A NOTE ON CREDENTIAL WALLETS

2.4 DIGITAL CREDENTIALS COMPARISON TABLE

	Digital Signatures (Docusign)	Open Badges	Blockcerts
In Use Since	1977 Con in o r e ol ing in m iple perm ion v ih increa ing le el of ec ri .	2011 Mo c rren andard a of repor p blica ion i Open Badge 2.0.	2016
Format	PDF Fi ed la o a doc men con aining e and image da a oge her in a h man-readable di pla forma.	PNG and JSON Fi ed image forma all con ned o a imple hape. Thi image ma poin o ho ed JSON da a abo he badge.	JSON Con ain bo h e and image da a and can gener e an pe of di pla forv eb, mobile, and prin.
Data	Fle ible da a forma.	The andard OB framev ork con ain a core es of da a, e pandablev ih OB e en ion .	Fle ible da a forma. C rren l ar v ih OB core da a es.
Timestamping	Ye	Ye	Ye
Data Integrity & Tamper Evidence	Ye Digi al igna re di pla amper e idence of bo h di pla and pporing me ada a.	No Ho ed a er ion co ld be modi ed b he i er and ill pa eri ca ion.	Ye Digi al igna re and blockchain ha hing di pla amper e idence of bo h di pla and pporing me ada a.
Credentials Type/Ideal Use Cases	Legal agreemen be ween m iple par ie ; high- ake creden ial ; diploma and degree ; academic ran crip ; v ill ; profe ional licen e ; proper ible ; al record (bir h/dea h/marriage cer i ca e); proof of in rance.	Micro-creden ial repre en ing a ingle kill or achie emen : co r e comple ion, kill a ainmen , or mile one achie emen .	High- ake creden ial ; diploma and degree ; academic ran crip ; eri ca ion of pa ed ca ion; profe ional licen e ; proper ible ; al record (bir h/dea h/marriage cer i ca e); ID card ; dri er' licen e ; pa por ; proof of in rance.
Shareable (Online & Peer to Peer)	Ye	Ye	Ye

	Digital Signatures (Docusign)	Open Badges	Blockcerts
Revocable	No. An a ,hori, ' igning ke ma be re oked, b ,hi v ill no, re oke, or in alida,e, ,he Digi,al Signa, re ed ,o ign doc men, ,ha, ha e alread been digi,all igned b ,ha, a ,hori, .	Ye	Ye
Expirable	No. Cer,i, ca,e doc men,ing ov ner hip of igning ke ma e pire, b , Digi,al Signa, re alread made b ,he ov ner of ,ho e igning ke do no,.	Ye	Ye
Legally Enforceable	Ye	Un igned badge are	

2.5 AN EYE TOWARD THE FUTURE

The f re of credenialing and echnological andard emplo ed o en re alidi and a henicic remain id. The follo v ing y o ecion highligh y o area of noe, e peciall rele an o ho e looking a long-erm iabili of heir cho en mode of digii aion.

W3C VERIFIABLE CREDENTIALS

While hi Repor i foc ed on a ailable echnologie , i impor an o noe ho v he pace i e ol ing o help en re choice oda aren' o moded in he f re. Therefore, hi Repor an icipae he ongoing v ork of he World Wide Web Con ori m (W3C) for Veri able Creden ial . The v eigh of major pla er (Micro of, Ma ercard, So rin, Learning Machine) con rib ing o or commi ing o e he Veri able Creden ial chema gge ha i v ill be a major andard for digi al creden ial in he f re.

The W3C i he primar in erna ional andard organi aion for he World Wide Web. Originall formed b Tim Berner -Lee in 1994, he andard organi aion ha grov n o 476 member a of Oc ober 2018. In 2013, he W3C Creden ial Comm ni Gro p began v ork in he creden ial pacev ih he inen of enabling he ec re e pre ion of eri able informa ion ia he Web. Thi ini ia i e v a o on follo ed b he Reboo ing Web of Tr Comm ni and W3C Veri able Claim Working Gro p, ince renamed Veri able Creden ial .

Thi Re ol ion an icipa e f re reg la ion of Di rib ed Ledger Technolog (DLT) and he changing role of Tr Ser ice Pro ider nder a decen rali ed frame ork. b Sec ion 17 e plici reference Blockcer a a al able applica ion of blockchain-ba ed cer i, ca ion.

In he Uni ed S a e ,m biple a e ,incl ding Ari ona, Tenne ee, and Ne ada ha e pa ed legi la ion o en re he legal alidi of mar con rac and Digi al Signa re anchored in blockchain .Ho e er, he Uniform La Commi ion and he Digi al Chamber of Commerce, a blockchain ad ocac gro p, arg e ha e i ing la pro ide e cien legal gro nd for he accep ance of blockchain-ba ed mar con rac and Digi al Signa re .[5] Ho he e are rea ed in he legal em remain o be een, b i i likel , gi en he imilari ie in he echnologie in ol ed, ha ca e ill pro e analogo o ho e alread li iga ed o er Digi al Signa re .

3. RECOMMENDATIONS & CONCLUSION

The proce e of i ing and main aining he e creden ial ,like man admini ra i e f nc ion ,1 deepl roo ed in he pa and ma no be iable for he need of he c rren and f re heal hcare en ironmen. The c rren a e of ph ician licen ing and creden ialing i ine cien, ha ec ri concern ,and gi e ner hip of an indi id al' creden ial o in i ion and n2 (hld)-9 ((cep of)0.5 (he)4 m BT0.047 T

change ha peci, call addre e i ing ine„ ciencie and barrier .

To achie e he promi e of he echnologie highligh ed in hi Repor, here m be r ide v illingne o e al a e proce and implemen change ha peci, call addre e i ing ine ciencie and barrier he e barrier ho onl ov do n he proce for he ph ician and he end- er of ph ician creden ial o al o compromi e p blic afe en da a ho ithin heal hcare propaga e gap in he da a a ailable o reg la or and creden ial peciali ,bima el inhibiing acce o (cep of)6 (e

organi ion ,he ork ,federal and a e reg la or ,and he em a av hole. Recogni ing he need

profe ional from he da ing collec ion and re ie v of paper-ba ed doc men and allo heir e„ or o foc on a„ managemen, ongoing compliance and enforcemen e„ or , and impro ed q ali andard . The re earch in hi paper ho v ha here are m iple echnical ol ion ha mee legal and reg la or req iremen and a he ame ime deli er doc men por abili , independence, and he le el of r pa ien e pec in modern hea hcare deli er model .

Digital credentials may free up state licensing staff or medical staff professionals from the daunting collection and review of paper-based documents and allow their efforts to focus on staff management, ongoing compliance and enforcement efforts, and improved quality standards.

B beginning no v , he FSMB i an earl mo er; ho e er, i v ill adop and main ain an e ol ionar approach. i r ep v ill be o pda e i em o nb ndle creden ial o heir ba e elemen o allo hem o be deli ered indi id all . For he FSMB, hi ep i eq ired in order o adj i v ork o v and deli er prod c o mee f re need . The e change are madev ih a clear nder anding ha he mechani m o deli er he e doc men v ill change o er ime. *It is expected that the first incarnation of these documents will be delivered using digital certificates.*

For organi ion con idering adop ing a ne v model, i i v or h con idering he follo ing ma im ha ha e been iden i ed hro gh recen FSMB projec and collabora ion th he creden ialing pace:

The digi al ran forma ion in creden ialing i ill in i earl da , and he FSMB look for ard o v orking v ih o r con i en , incl ding a e medical board , o her er of i eri ed doc men , and he ed ca ional in i ion v ho o of en ac a o rce informa ion pro ider and v ho are al o looking a ne v model of deli ering and con ming creden ial . If he po en ial of digi al creden ial o pro ide

GLOSSARY

Asymmetric Cryptography: The e of p blic and pri a e ke o encr p and decr p da a. The ke are a e of large n merical ring ha ha e been paired oge her b are no iden ical (a mme ric). One ke in he pair can be ared v ih e er one; i i called he p blic ke . The o her ke in he pair i kep ecre; i i called he pri a e ke . Ei her of he ke can be ed o encr p a me age; he oppo e ke from he one ed o encr p he me age i ed for decr p ion.

Blockchain: A pe of di rib ed ledger inv hich modi, ca ion o he ledger are appended a block of ran ac ion ordered eq en ial in ime. Once a block ha been appended o he e rie of pre io block , i cr p ographicall igned, replica ed acro node r nning he da aba e pro ocol, and can no longer be a ered b an da aba e er. In o herv ord , a blockchain can be ho gh of a an append-onl , imm able da aba e of ran ac ion .Blockchain v ere originall ed o main ain record of v ner hip of digi al c rrenc , hereb pre en ing i replica ion (and de al a ion). Thi allo v ed digi al c rrenc o come in ov ide e for he , r imev ih he Bi coin pro ocol. Ho v e er, he ame echnolog primi i e can be emplo ed o erif he in egri of and rack o v ner hip of an digi al a e , incl ding a medical creden ial.

Certificate Authority (CA): A hird-par er icev hich cer i, e o v ner hip of p blic ke i ing Digi al Cer i, ca e .

Decentralized Identifiers (DIDs): A globall niq e iden i, er ha doe no req ire a cen rali ed regi ra ion a hori beca e i i regi ered v ih di rib ed ledger echnolog or o her form of decen rali ed ne ork.

Digital Signature: A mean of crea ing an elec ronic igna re ha i niq e o he per on ing i, i capable of eri, ca ion, i nder he ole con rol of he per on ing i, and i linked o da a in a manner ch ha if he da a i changed, he igna re i in alida ed.

Distributed Ledgers (DLT): A da aba e ha i con en all ared and nchroni ed acro m iple e , in a ion or geographie .The par icipan a each node of he ne ork can acce he recording ared acro ha ne ork and can o n an iden ical cop of i. F r her, an change or addi ion made o he ledger are re ec ed and copied o all par icipan .A blockchain i a pe of di rib ed ledger.

JavaScript Object Notation (JSON): A ligh eigh da a-in erchange forma ba ed on a b e of he Ja aScrip Programming Lang age, S andard ECMA-262 3rd Edi ion - December 1999. JSON i a e forma ha i comple el lang age independen b e con en ion ha are familiar o programmer of he C-famil of lang age , ch a C, C++, C#, Ja a, Ja aScrip, Perl, and P hon.

JSON Web Signature (JWS): A compac igna re forma in ended for pace con rained en ironmen ch a HTTP A hori a ion header and URI q er parame er . repre en igned con en ing JSON da a r c re .The JWS igna re mechani m are independen of he pe of con en being igned, allo ing arbi rar con en o be igned.

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Cornell La School, Legal Informa...ion In ...i ...e. Adhe ion Con...rac... (Con...rac... of Adhe ion). h...p ://w v v .la .cornell.ed / e /adhe ion_con...rac... %28con...rac... of_adhe ion%29

Co ncil of ...he E ropean Union. 2014. Reg la...ion (EU) No 910/2014 of ...he E ropean Parliamen... and of ...he Co ncil of 23 J l 2014 on elec...ronic iden...i...ca...ion and ...r ... er ice for elec...ronic ...ran ...ac...ion ...h ...he in...ernal marke... and repealing Direc...i e 1999/93/EC. h...p ://e r-le . e ropa.e /legal-con...en.../en/TXT/? ri=CELEX:32014R0910.

Doc Sign. Elec...ronic ...igna... re la ...b ...a...e. h...p ://w v v .doc ign.com/e igna... re/elec...ronic- igna... re-la ...a...e.

Doc Sign. US elec...ronic ...igna... re la and hi ...or . h...p ://w v v .doc ign.com/learn/ elec...ronic- igna... re-la and-hi ...or .

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