



IT KOLLEDŽ
TALLINNA TEHNIKAÜLIKOOL

Varundamine, taastamine

Andmesalvestustehnoloogiad I395

Edmund Laugasson

edmund.laugasson@itcollege.ee

https://wiki.itcollege.ee/index.php/User:Edmund#eesti_keeles

Käesoleva dokumendi paljundamine, edasiandmine ja/või muutmine on sätestatud ühega järgnevatest litsentsidest kasutaja valikul:

* GNU Vaba Dokumentatsiooni Litsentsi versioon 1.2 või uuem

* Creative Commons Autorile viitamine + Jagamine samadel tingimustel 4.0 litsents (CC BY-SA)

Loengu teemad

- Varundamine ja taaste
- CRON ja crontab
- Arhiveerimine



Milleks meile varundamine, kui ... ?



Dilbert.com DilbertCartoonist@gmail.com

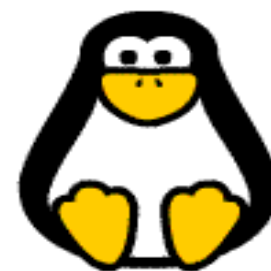


9-6-13 © 2013 Scott Adams, Inc./Dist. by Universal Uclick



Milleks meile varundamine, kui ... ?

- Avalik internetiarhiiv <https://archive.org/> - otsige mõne soovitud veebilehe varasemaid versioone – esimese otsinguga antakse vihje, et antud veebilehte võiks hakata lisama arhiivi
- Vt ka KKK <https://archive.org/about/faqs.php>
 - <https://archive.org/about/faqs.php#26>
 - <https://archive.org/about/faqs.php#189> - SLA ~90%
 - https://archive.org/about/faqs.php#The_Wayback_Machine
 - <https://archive.org/about/faqs.php#Archive-It>
 - <https://archive-it.org/>



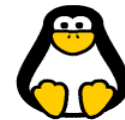
Võrgupõhine varundamine



- Võrgupõhine varundamine (*online backup*) – milline on selliste varunduslahenduste turvalisus?
 - uurida järgnevatel slaididel pakutud võrgupõhiste varunduste turvalisust
 - *zero knowledge* – krüptograafia kontseptsioon kus inter: üks pool tõestab teisele (matemaatiliselt) väite tõesust paljastamata muud kui väite tõesust – nt salasõna taastamine ilma teenusepakkuja poolt salasõna teadmata – vaid teenusekasutajale teadaoleva võtmega krüpteeritud (teenusekasutaja saab võtit soovitud tihedusega vahetada)
 - ZKPP – *Zero Knowledge Password Proof* – salasõna suudetakse taastada, teenusepakkuja väidetavalt ei oma ligipääsu
 - **ideaalis teenusepakkuja ei paku salasõna taastamist**
 - *zero access* – andmeid hoitakse krüpteeritult,



Zero knowledge...



- vt artikkel

<https://blog.cryptographyengineering.com/2014/11/27/zero-knowledge-proofs-illustrated-primer/>

- tuuakse näide Google baasil
- Google kvantarvuti (vt **viited** → *Quantum computing*)
- teenusepakkuja väidetav mitteligi pääsemine – kas usute?



**“ OUR
QUANTUM COMPUTER
IS
100 MILLION TIMES FASTER
THAN PC.**

- GOOGLE



Zero knowledge näiteid

- <https://tresorit.com/blog/zero-knowledge-encryption/>
- <https://tresorit.com/security>
- <https://suchanek.name/texts/reviews/tresorit.html>
- <https://support.tresorit.com/hc/en-us/articles/216113777-Crash-course-on-Tresorit>
- vt *"Where does Tresorit store data?"* → Microsoft Azure →
<https://danielzstinson.wordpress.com/cloud-computing-may-not-be-as-secure-as-you-would-like-to-believevulnerabilities-in-azure-part-2/>

Bullet-proof security for your files. Tested by 1000+ hackers.



Zero-knowledge

Data is encrypted before it leaves your device. Only you and those who you share with can access your data.



Proven security

1000+ hackers, including experts from MIT and Stanford tried to break our security for \$50,000. No one succeeded.



Swiss privacy

You are protected from foreign surveillance and data warrants by Swiss privacy law. Datacenters are located in the European Union.



Compliance

Tresorit security is fully HIPAA compliant. Datacenters meet ISO27001:2013 standards and comply with a host of other certifications.



Digital rights management

Access to any Office document can be modified or revoked in an instant, even if a file was downloaded to a device.



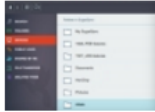

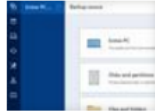

► [Learn why even our admins can't see your data](#)

The Best Online Backup Services of 2016

BY MICHAEL MUCHMORE NOVEMBER 23, 2016 4 COMMENTS



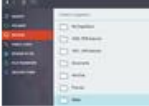















<http://www.pcmag.com/article2/0,2817,2288745,00.asp>

To protect your files you need to back them up, and keeping your backup off-site is the best way to ensure its safety. Here are the best online backup services available.

Name	IDrive	CrashPlan	SOS Online Backup	SugarSync	Carbonite	SpiderOakONE	Acronis True Image Cloud	Backblaze	EMC MozyHome	OpenDrive
										
Lowest Price	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT
Editor Rating	●●●●● EC	●●●●● EC	●●●●● EC	●●●●○	●●●●○	●●●●○	●●●●○	●●●●○	●●●●○	●●●●○
Storage	1TB	Unlimited	Unlimited	100GB	Unlimited	1TB	Unlimited	Unlimited	50GB	500GB
Free Storage	5GB	0	0	None	0	2GB	0	0	2GB	5GB
Number of Computers	Unlimited	1	1	Unlimited	1	Unlimited	1	1	3	1
Continuous Backups	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓
Full Disk Backups	✓	✓	✗	✗	✓	✓	✓	✓	✓	✗
File Sharing	✓	✗	✓	✓	✓	✓	✓	✗	✗	✓
Explorer Integration	✓	✗	✗	✓	✓	✓	✓	✗	✓	✓
Folder Syncing	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓
Versions Saved	10	Unlimited	Unlimited	6	12	Unlimited	6	Unlimited	Unlimited	99
Version Retention	Unlimited	Unlimited	Unlimited	30 Days	90 Days	Unlimited	6 Months	30 Days	30 Days	Unlimited
Backup to Local Storage	✓	✓	✓	✗	✗	✓	✓	✓	✓	✗
Read Review	IDrive Review	CrashPlan Review	SOS Online Backup Review	SugarSync Review	Carbonite Review	SpiderOakONE Review	Acronis True Image Cloud Review	Backblaze Review	EMC MozyHome Review	OpenDrive Review

The Best Online Backup Services of 2017

<https://www.pcmag.com/article2/0,2817,2288745,00.asp>


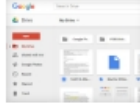
Product	IDrive	SpiderOakONE	SugarSync	SOS Online Backup	Acronis True Image	Backblaze	OpenDrive	Carbonite	MozyHome
									
Lowest Price	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT		
Editors' Rating	 EDITORS' CHOICE			 EDITORS' CHOICE	 EDITORS' CHOICE				
Storage	2TB	1TB	100GB	Unlimited	250 GB	Unlimited	500GB	Unlimited	50GB
Free Storage	5GB	2GB	None	0	None	0	5GB	0	2GB
Number of Computers	Unlimited	Unlimited	Unlimited	1	1	1	1	1	3
Continuous Backups	✓	✓	✓	✓	✓	✓	✓	✓	✓
Full Disk Backups	✓	✓	—	—	✓	✓	—	✓	✓
File Sharing	✓	✓	✓	✓	✓	✓	✓	✓	—
Explorer Integration	✓	✓	✓	—	—	—	✓	✓	✓
Folder Syncing	✓	✓	✓	✓	✓	—	✓	✓	✓
Versions Saved	10	Unlimited	6	Unlimited	6	Unlimited	99	12	Unlimited
Version Retention	Unlimited	Unlimited	30 Days	Unlimited	6 Months	30 Days	Unlimited	90 Days	30 Days
Backup to Local Storage	✓	✓	—	✓	—	✓	—	—	✓

The Best Cloud Storage and File-Sharing Services for 2016

BY MICHAEL MUCHMORE, JILL DUFFY SEPTEMBER 23, 2016 2 COMMENTS










<http://www.pcmag.com/roundup/306323/the-best-cloud-storage-providers-and-file-syncing-services>

Why waste valuable storage space on your PC or phone when you can store your documents and media in the cloud and share it across devices? These top-rated services let you do just that.

Name	IDrive	SugarSync	Microsoft OneDrive	SpiderOakONE	CertainSafe Digital Safety Deposit Box	Google Drive	Apple iCloud Drive	Box (Personal)	Dropbox
									
Lowest Price	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	
Editor Rating	●●●●● EC	●●●●○	●●●●● EC	●●●●○	●●●●● EC	●●●●● EC	●●●●○	●●●●● EC	●●●●○
Area of Specialization	Backup	Simplicity, Ease of Use	Collaboration; Microsoft Office 365 Included With 1TB Purchase	Security	Security	Collaboration	Apple Device Users	Compatibility With Other Services; Business Use	Compatibility With Other Services
File Size Limit	Unlimited	Unlimited	10GB	Unlimited	100GB	5TB	15GB	250MB With Free Account; 2GB With Starter Account	10GB; Unlimited With Desktop Client
Free Storage	5GB	None	5GB	2GB	None	15GB	5GB	10GB	2GB
Online Editing	✗	✗	✓	✗	✗	✓	✓	✗	✗
File Versioning	✓	✓	✓	✓	✓	✓	✓	✓	✓
Windows App	✓	✓	✓	✓	✗	✓	✓	✓	✓
iOS App	✓	✓	✓	✓	✗	✓	✗	✓	✓
Android App	✓	✓	✓	✓	✗	✓	✗	✓	✓
Read Review	IDrive Review	SugarSync Review	Microsoft OneDrive Review	SpiderOakONE Review	CertainSafe Digital Safety Deposit Box Review	Google Drive Review	Apple iCloud Drive Review	Box (Personal) Review	Dropbox Review

The Best Cloud Storage and File-Sharing Services of 2017

<https://www.pcmag.com/roundup/306323/the-best-cloud-storage-providers-and-file-syncing-services>

Product	IDrive	SugarSync	SpiderOakONE	Microsoft OneDrive	CertainSafe Digital Safety Deposit Box	Google Drive	Apple iCloud Drive	Box (Personal)	Dropbox
Lowest Price	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	
Editors' Rating	 EDITORS' CHOICE			 EDITORS' CHOICE	 EDITORS' CHOICE	 EDITORS' CHOICE	 EDITORS' CHOICE	 EDITORS' CHOICE	
Area of Specialization		Simplicity, Ease of Use	Security	Collaboration; Microsoft Office 365 Included With 1TB Purchase	Security	Collaboration	Apple Device Users	Compatibility With Other Services; Business Use	Compatibility With Other Services
File Size Limit		Unlimited	Unlimited	10GB	100GB	5TB	15GB	250MB With Free Account; 2GB With Starter Account	10GB; Unlimited With Desktop Client
Free Storage	5GB	None	2GB	5GB	None	15GB	5GB	10GB	2GB
Online Editing	—	—	—	✓	—	✓	✓	—	—
File Versioning	—	✓	✓	✓	✓	✓	✓	✓	✓
Windows App	—	✓	✓	✓	—	✓	✓	✓	✓
iOS App	—	✓	✓	✓	—	✓	✓	✓	✓
Android App	—	✓	✓	✓	—	✓	—	✓	✓

Varundamine

- Varundamise vajadus
 - *Disaster recovery* e katastroofi/*force majeure* (vääramatu jõud) jaoks varundamine
 - Ujutused, loodusõnnetused, sõda jms
 - *Operational recovery* e igapäevaste tegevuste tõttu varundamine
 - Ketta hävimine
 - Pahatahtlik ja tahtmatu kustutamine
 - Arhiveerimise eesmärgil



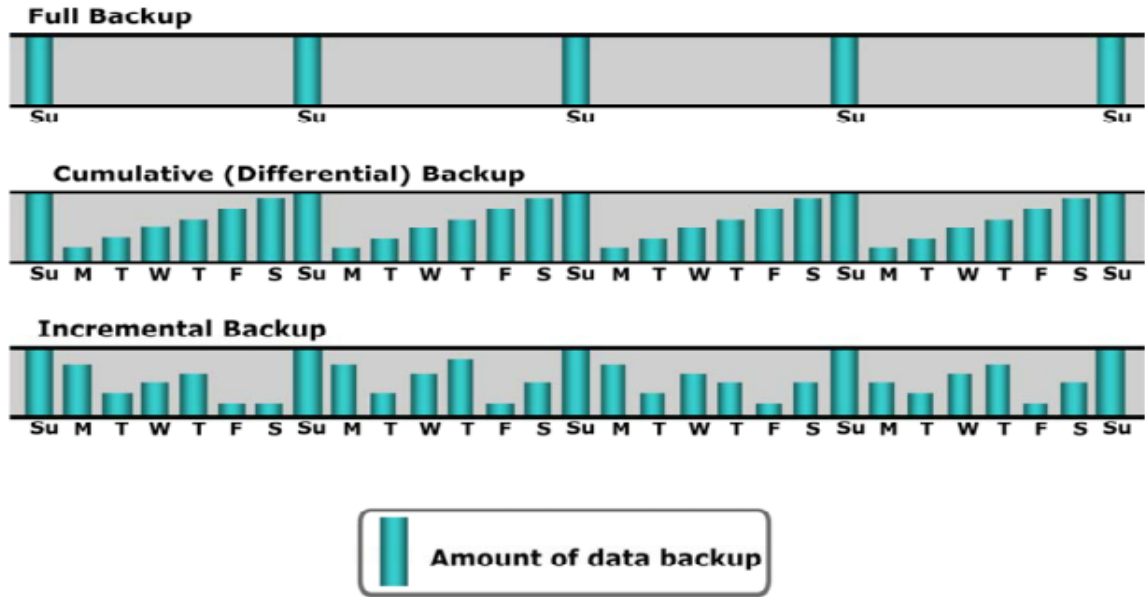
Katastroofide jaoks varundamine

- Ujutused, loodusõnnetused, sõda jms
 - Serveriruumi tasemel
 - Riistvaralisel tasemel
 - Tarkvaralisel tasemel



Operatiivandmete varundamine

- Varundamise granulaarsus
 - Täisvarundamine (*Full*)
 - Kumulatiivne varundamine (*Cumulative*)
 - Lisanduvvarundamine (*Incremental*)



Reklaamipaus



Varundamine



- Varundamise meetodid
 - Külm varundamine (*Cold backup*)
 - *Rakendus seisab ning kasutajaid pole küljes*
 - *Miinus: rakenduse seisak*
 - Kuum varundamine (*Hot backup*)
 - *Rakendus käib ning kasutajad on aktiivselt küljes*
 - *Miinus: mõju jõudlusele*
 - Hetkeseisu varundamine (*Point in time*)
 - *Virtuaalsele kettale kopeeritakse andmete asukoha info*
 - *Hetkeline rakenduse seisak või andmete „külmutus“*

Varundamine

- Varundamisvahendid
- Kohalikud
 - Kõvakettad serveris
- Välised
 - Kõvakettad varundusserveril
 - Lindiseadmed
 - Paber (<http://ollydbg.de/Paperbak/>)



Varundamine

- Efektiivsuse tõstmismeetodid
 - *Compression* - kokkupakkimine pakkimisalgoritmi järgi
 - *Deduplication* – duplikaatide eemaldamine
 - *Multiplexing* – Varundamine toimub samaaegselt mitmest allikast üle ühe kanali
 - *Disk staging* – D2D2T ehk kasutatakse vahesalvestuskohti enne linti kirjutamist



Varundamine

- Käideldavuse tõstmine
 - *Single-point-of-failure* välistamine
 - Multipath
 - Cold/Hot Standby
 - Kohalik- ja kaugreplitseerimine (täpse koopia sünkimine kohalikult või kaugvahenditele)
 - Klasterdamine



CRON



- ... teenus, mis käivitab ajastatud toiminguid
- */var/spool/cron/crontabs* ja */etc/cron.**
- Käivitab tegevused kasutaja alt ja õigustes
- *crontab* faili formaat
 - # Minute Hour Day of Month Month Day of Week Command
 - (0-59) (0-23) (1-31) (1-12 or Jan-Dec) (0-6 or Sun-Sat) /bin/sh
- süsteemilaine CRON - */etc/crontab* ja */etc/cron.d/** - neil on ka kasutaja väli, mida tavaliselt muidu ei ole
 - muutujad: *SHELL=/bin/sh*, *PATH=</...>:</...>*, *MAILTO=""*
- vaikimisi logitakse */var/log/syslog*

CRON ja crontab II



- Käsurealt kasutajapõhise CRON'i haldus:
 - `crontab -e #` avab kasutaja crontab faili editoris
 - `crontab -l #` nimekiri olemasolevatest kasutaja cron töödest
- turvalisuse kaalutlustel keelatakse tavakasutajatele CRON'i (varasemalt analoogselt ka *at*) kasutamine
 - iga kasutajanimi uult realt + lõpus vähemalt 1 tühi rida
 - `/etc/cron/allow` – kui eksisteerib siis kasutaja peab olema kirjas, et kasutada CRON'i
 - `/etc/cron.deny` – kui kasutaja kirjas siis kasutada ei saa
- olemas ka veebipõhised vahendid (vt [viited](#))

Arhiveerimine

- ... andmete kõrvale tõstmise ajaloo säilitamise huvides
- Salvestusseadmed
 - Lindiseadmed
 - Kõvakettad
 - Intelligentset salvestusvahendid
 - Paber! (<http://ollydbg.de/Paperbak/>)



Arhiveerimine





Tarkvara määratud salvestus

- SDS – *Software Defined Storage*
 - loogiline kiht
 - salvestuse virtualiseerimine – välise kontrolleri baasil (nt DAS)
 - virtuaalsed kettad (vVol) – VM Ware lahendus, iSCSI, FC
 - paralleelne NFS (pNFS) – kogukonna lahendus
 - võimalik ka üle erinevate lahenduste
 - poliitikapõhine automatiseerimine (SLA)
- näide: Ceph
 - <http://ceph.com/>
 - [https://en.wikipedia.org/wiki/Ceph_\(software\)](https://en.wikipedia.org/wiki/Ceph_(software))
 - <http://alternativeto.net/software/ceph/>

Viited

- Varundamine
 - <https://help.ubuntu.com/lts/serverguide/backups.html>
 - <https://help.ubuntu.com/community/BackupYourSystem>
 - https://en.wikipedia.org/wiki/List_of_backup_software - vt viited lõpus
 - https://en.wikipedia.org/wiki/Comparison_of_file_hosting_services
 - https://en.wikipedia.org/wiki/Comparison_of_online_backup_services
 - <https://opensource.com/life/15/12/5-open-source-web-apps-self-hosted>
 - <https://www.grc.com/sn/sn-349.htm>
 - <http://www.cloudwards.net/top-10-secure-dropbox-alternatives/>
 - <http://www.hongkiat.com/blog/online-storage-with-encryption/>
 - <http://www.cryptoheaven.com/>

Viited

- CRON
 - <https://help.ubuntu.com/community/CronHowto>
 - <http://crontab-generator.org/>
 - <https://crontab.guru/>
 - <http://cron.nmonitoring.com/cron-generator.html>
 - <http://www.corntab.com/>

Küsimused? Tänan tähelepanu eest!



IT KOLLEDŽ
TALLINNA TEHNIKAÜLIKOOL



TTÜ IT KOLLEDŽ

Raja 4C, 12616 Tallinn

tel +372 628 5800

info@itcollege.ee

<http://www.itcollege.ee/>