Εισαγωγή στον Προγραμματισμό

Εισαγωγική ενότητα (25%) : Βασικές έννοιες και τομείς της Επιστήμης Υπολογιστών 5η ομιλία

Παναγιώτης Τζουνάκης

Χειμώνας 2026



Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης



Παρένθεση: λίγη βιβλιογραφία (για τολμηρούς)

- Donald E. Knuth - The Art of Computer Programming – 1968 and still updating! https://cs.stanford.edu/~knuth/taocp.html
- M. Morris Mano - Computer System Architecture (3rd Edition)-Prentice Hall (1992)
- M. Morris Mano, Michael D. Ciletti – Digital Design With an Introduction to the Verilog HDL – 5th edition, 2013 PEARSON
- M. Morris R. Mano, Charles R. Kime, Tom Martin = Logic and computer design fundamentals – 5th edition, 2015 PEARSON
- John L. Hennessy, David A. Patterson – Computer Architecture A Quantitative Approach- Sixth-Edition 2019 Elsevier
- Claude E. Shannon, Warren Weaver - The Mathematical Theory of Communication (1971, The University of Illinois Press)
- Glenn Brookshear, Dennis Brylow - Computer Science - An Overview- Pearson Education Limited (2015)
- Les Goldschlager, Andrew Lister - Εισαγωγή Στη Σύγχρονη Επιστήμη Των Υπολογιστών (μετάφραση Κ. Χαλάτση 1994)
- Tom Wong, Introduction to Classical and Quantum Computing (Feb. 27, 2022) βλ. Chapter 1 http://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e2p.pdf
- Ming Li_ Paul Vitányi - An Introduction to Kolmogorov Complexity and Its Applications (Texts in Computer Science) (2019, Springer 1st ed 1993)
- Lewis H, Papadimitriou C – Elements of the Theory of Computation, 1998 2nd ed
- Christos H. Papadimitriou-Computational Complexity-Addison-Wesley (1994)





Λειτουργικά Συστήματα

1. Ο ρόλος του Λειτουργικού Συστήματος (αρμοδιότητες – ευθύνες)
2. Ιστορία & εξέλιξη
3. Δομή – ιεραρχία του ΛΣ
    1. Πυρήνας
    2. Οδηγοί συσκευών
    3. Σύστημα αρχείων
    4. Shell – user interface
    5. System calls
4. Διεργασίες (Processes)
    - Συγχρονισμός
    - πολυεπεξεργαστές
5. Λειτουργίες
    - CPU – scheduling
    - Κεντρική – εικονική μνήμη
    - Διαχείριση αρχείων
    - Διαχείριση εισόδου - εξόδου
6. Παραδείγματα ΛΣ
    - Unix
    - Windows
    - Android
    - MacOS, iOS





Ο ρόλος του Λειτουργικού Συστήματος

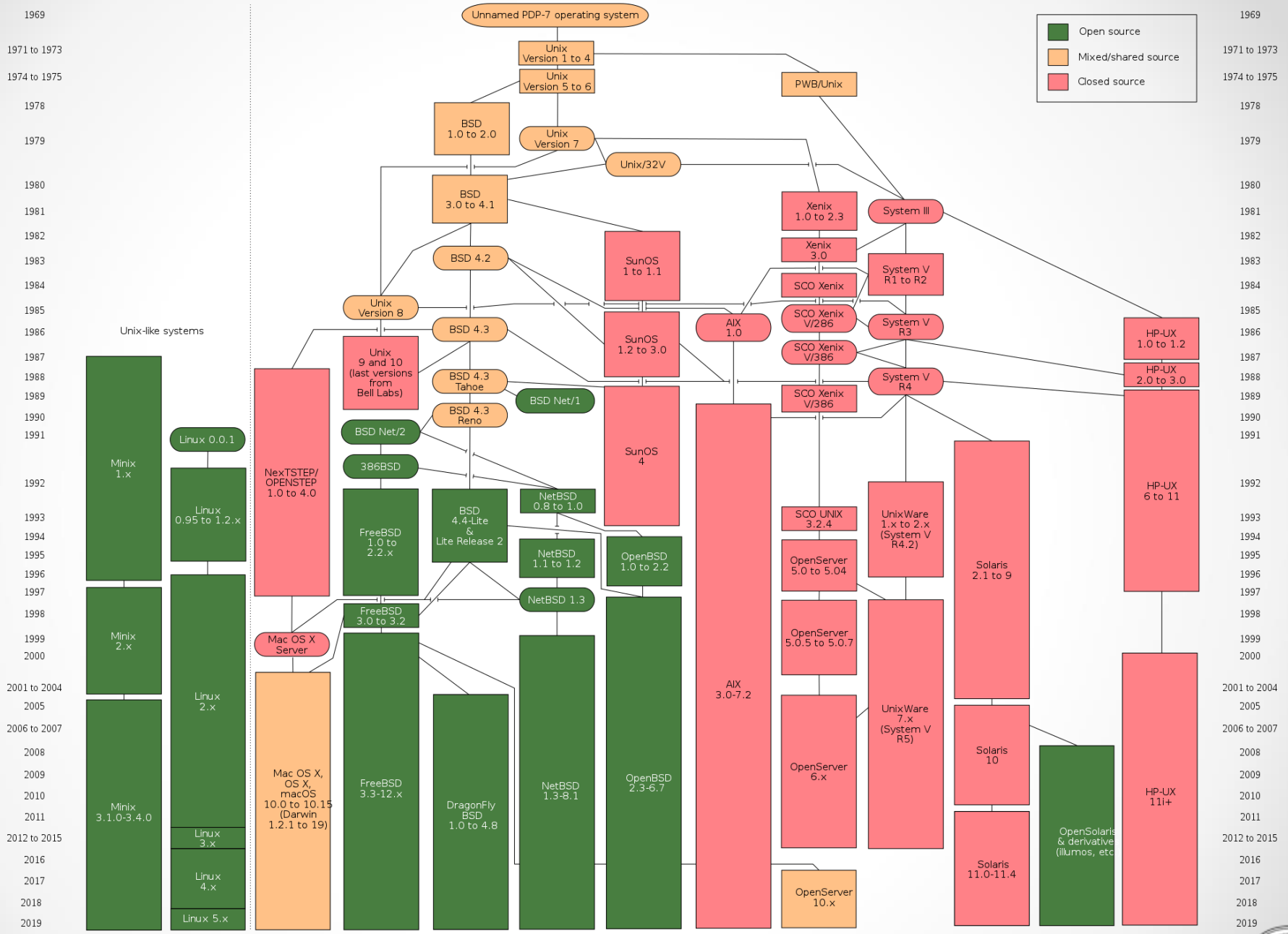
Ο «συντονιστής» (coordinator) του υπολογιστή

- Δρα ως **ενδιάμεσος κρίκος** ανάμεσα στον χρήστη της μηχανής (**άνθρωπο**) και το **υλικό** μεριμνώντας για την εκτέλεση των εντολών και την ικανοποίηση των απαιτήσεων του χρήστη από το υπολογιστικό σύστημα.
- **Διαχειρίζεται** τους διαθέσιμους **υπολογιστικούς πόρους** και τους κατανέμει στις διάφορες **διεργασίες**.
- **Ελέγχει** την εκτέλεση των προγραμμάτων στα οποία **επιβάλει** ορθή συμπεριφορά.
- Διαχειρίζεται όλες τις **συσκευές,** ειδικότερα όσον αφορά στην είσοδο/έξοδο ελέγχει τη ροή των δεδομένων με κατάλληλα πρωτόκολλα & πρότυπα επικοινωνιών, πολυμέσων, κ.α.
- Διαχειρίζεται το **σύστημα αρχείων (file system)** όπου οργανώνονται όλα τα αρχεία τα οποία προσπελαύνει ο υπολογιστής.
- **Παρακολουθεί** ανελλιπώς το υπολογιστικό σύστημα προκειμένου να **ενημερώνει** τους διαχειριστές και χρήστες για **βλάβες** στο υλικό, και **λάθη** ή **δυσλειτουργίες** στο λογισμικό συστήματος είτε εφαρμογών.
- Υλοποιεί πολιτικές που υπερασπίζονται την **ασφάλεια** του υπολογιστή από διάφορους κινδύνους εφαρμόζοντας μηχανισμούς σε διάφορα επίπεδα.

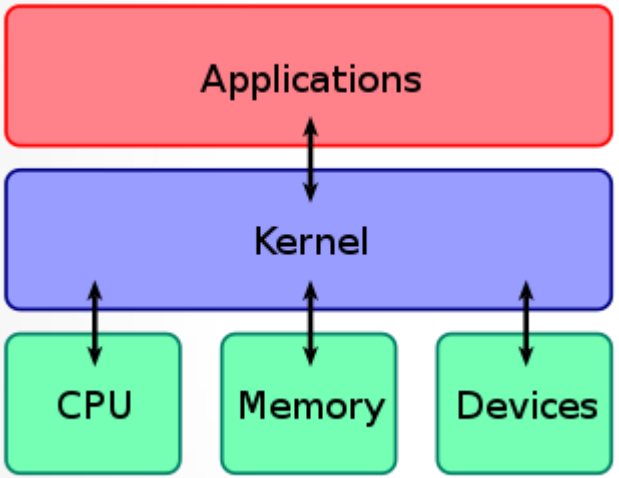


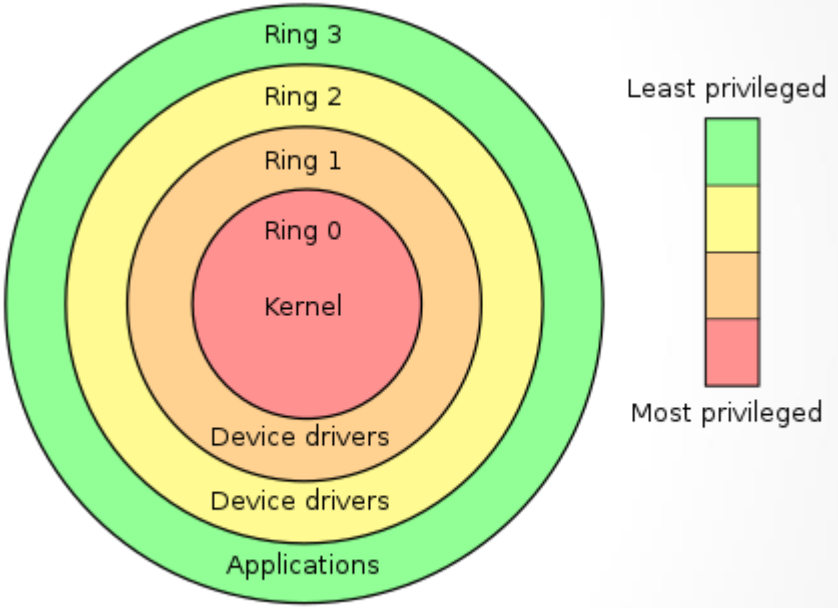


Ιστορική εξέλιξη Unix



Δομή – ιεραρχία του ΛΣ





(Υπολογιστικές) Διεργασίες

https://en.wikipedia.org/wiki/Process_(computing)

Τα υπολογιστικά «όντα» που «ζουν» μέσα στην πλάση του ΛΣ, μοιραζόμενα CPU, μνήμη, κ.α. πόρους μέσω του ΛΣ.

Κάθε πρόγραμμα/εφαρμογή παρέχει το “DNA” για να γεννηθεί μια ή περισσότερες υπολογιστικές διεργασίες.

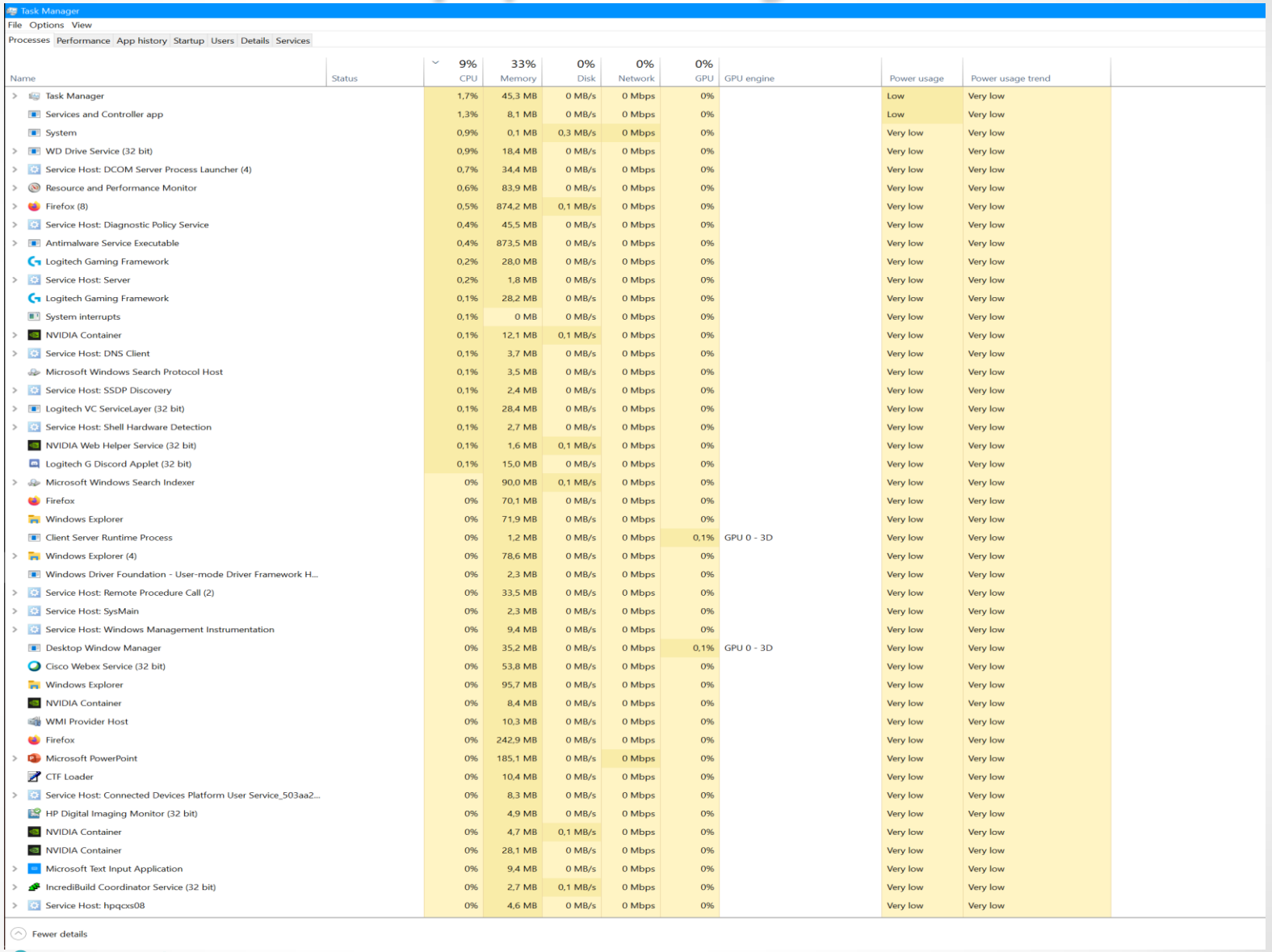
Μια διεργασία απαρτίζεται από:

- Μια εικόνα εκτελέσιμου κώδικα σε γλώσσα μηχανής
- Την περιοχή μνήμης που δεσμεύει για αποθήκευση του κώδικα και των (δομών) δεδομένων που επεξεργάζεται
- Περιγραφή των πόρων (π.χ. αρχεία) που τις έχει διαθέσει το ΛΣ
- Χαρακτηριστικά ασφάλειας και δικαιωμάτων που διαθέτει
- Το περιβάλλον (context) της CPU : μια εικόνα των καταχωρητών, PC, IR, κλπ που διατηρείται «παγωμένη» ανάμεσα στα χρονικά διαστήματα οπότε τρέχει η διεργασία στη CPU





Διεργασίες



Name	Status	9% CPU	33% Memory	0% Disk	0% Network	0% GPU	GPU engine	Power usage	Power usage trend
Task Manager		1,7%	45,3 MB	0 MB/s	0 Mbps	0%		Low	Very low
Services and Controller app		1,3%	8,1 MB	0 MB/s	0 Mbps	0%		Low	Very low
System		0,9%	0,1 MB	0,3 MB/s	0 Mbps	0%		Very low	Very low
WD Drive Service (32 bit)		0,9%	18,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: DCOM Server Process Launcher (4)		0,7%	34,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Resource and Performance Monitor		0,6%	83,9 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Firefox (8)		0,5%	874,2 MB	0,1 MB/s	0 Mbps	0%		Very low	Very low
Service Host: Diagnostic Policy Service		0,4%	45,5 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Antimalware Service Executable		0,4%	873,5 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Logitech Gaming Framework		0,2%	28,0 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: Server		0,2%	1,8 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Logitech Gaming Framework		0,1%	28,2 MB	0 MB/s	0 Mbps	0%		Very low	Very low
System interrupts		0,1%	0 MB	0 MB/s	0 Mbps	0%		Very low	Very low
NVIDIA Container		0,1%	12,1 MB	0,1 MB/s	0 Mbps	0%		Very low	Very low
Service Host: DNS Client		0,1%	3,7 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Microsoft Windows Search Protocol Host		0,1%	3,5 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: SSDP Discovery		0,1%	2,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Logitech VC ServiceLayer (32 bit)		0,1%	28,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: Shell Hardware Detection		0,1%	2,7 MB	0 MB/s	0 Mbps	0%		Very low	Very low
NVIDIA Web Helper Service (32 bit)		0,1%	1,6 MB	0,1 MB/s	0 Mbps	0%		Very low	Very low
Logitech G Discord Applet (32 bit)		0,1%	15,0 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Microsoft Windows Search Indexer		0%	90,0 MB	0,1 MB/s	0 Mbps	0%		Very low	Very low
Firefox		0%	70,1 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Windows Explorer		0%	71,9 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Client Server Runtime Process		0%	1,2 MB	0 MB/s	0 Mbps	0,1%	GPU 0 - 3D	Very low	Very low
Windows Explorer (4)		0%	78,6 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Windows Driver Foundation - User-mode Driver Framework H...		0%	2,3 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: Remote Procedure Call (2)		0%	33,5 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: SysMain		0%	2,3 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: Windows Management Instrumentation		0%	9,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Desktop Window Manager		0%	35,2 MB	0 MB/s	0 Mbps	0,1%	GPU 0 - 3D	Very low	Very low
Cisco Webex Service (32 bit)		0%	53,8 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Windows Explorer		0%	95,7 MB	0 MB/s	0 Mbps	0%		Very low	Very low
NVIDIA Container		0%	8,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
WMI Provider Host		0%	10,3 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Firefox		0%	242,9 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Microsoft PowerPoint		0%	185,1 MB	0 MB/s	0 Mbps	0%		Very low	Very low
CTF Loader		0%	10,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Service Host: Connected Devices Platform User Service_503aa2...		0%	8,3 MB	0 MB/s	0 Mbps	0%		Very low	Very low
HP Digital Imaging Monitor (32 bit)		0%	4,9 MB	0 MB/s	0 Mbps	0%		Very low	Very low
NVIDIA Container		0%	4,7 MB	0,1 MB/s	0 Mbps	0%		Very low	Very low
NVIDIA Container		0%	28,1 MB	0 MB/s	0 Mbps	0%		Very low	Very low
Microsoft Text Input Application		0%	9,4 MB	0 MB/s	0 Mbps	0%		Very low	Very low
IncrediBuild Coordinator Service (32 bit)		0%	2,7 MB	0,1 MB/s	0 Mbps	0%		Very low	Very low
Service Host: hpqcxs08		0%	4,6 MB	0 MB/s	0 Mbps	0%		Very low	Very low

Διεργασίες

Task Manager

File Options View

Processes | Performance | App history | Startup | Users | Details | Services

Name	PID	Status	User name	CPU	Memory (active private working set)	UAC virtualization
System Idle Process	0	Running	SYSTEM	91	8 K	
Taskmgr.exe	3196	Running	panagiotis	02	48.420 K	Not allowed
System	4	Running	SYSTEM	01	20 K	
System interrupts	-	Running	SYSTEM	01	0 K	
svchost.exe	824	Running	SYSTEM	01	39.728 K	Not allowed
WDDriveService.exe	4356	Running	SYSTEM			
MsMpEng.exe	9976	Running	SYSTEM			
perfmon.exe	17316	Running	panagiotis			
dwm.exe	8768	Running	DWM-45			
svchost.exe	4284	Running	LOCAL SERVICE			
csrss.exe	26208	Running	SYSTEM			
explorer.exe	29668	Running	panagiotis			
services.exe	972	Running	SYSTEM			
svchost.exe	4588	Running	SYSTEM			
LCore.exe	15856	Running	panagiotis			
firefox.exe	7704	Running	panagiotis			
svchost.exe	1852	Running	LOCAL SERVICE			
svchost.exe	2176	Running	SYSTEM			
SearchProtocolHost.e...	324	Running	SYSTEM			
nvcontainer.exe	27144	Running	SYSTEM			
firefox.exe	18704	Running	panagiotis			
firefox.exe	3792	Running	panagiotis			
nvcontainer.exe	8476	Running	panagiotis			
svchost.exe	1824	Running	NETWORK SERVICE			
POWERPNT.EXE	20440	Running	panagiotis			
NVIDIA Web Helper.e...	14136	Running	panagiotis			
LCore.exe	3872	Running	dimitris			
SearchIndexer.exe	18956	Running	SYSTEM			
EpicGamesLauncher.e...	16632	Running	dimitris			
svchost.exe	4256	Running	SYSTEM			
atmgr.exe	22504	Running	dimitris			
CoordService.exe	4768	Running	SYSTEM			
laclient.exe	9252	Running	panagiotis			
WmiPrvSE.exe	6320	Running	NETWORK SERVICE			
ServiceLayer.exe	4380	Running	SYSTEM			

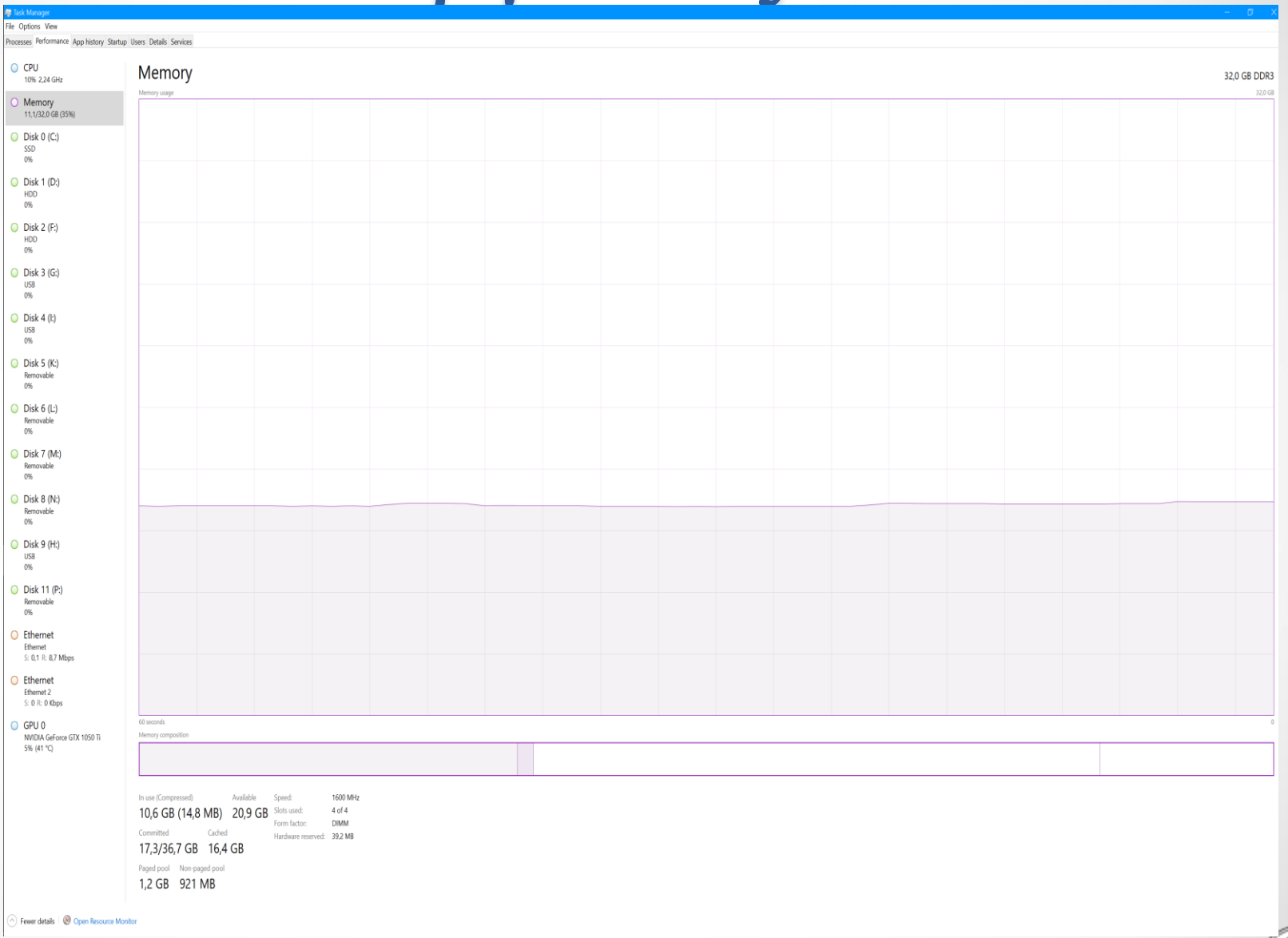
Task Manager

File Options View

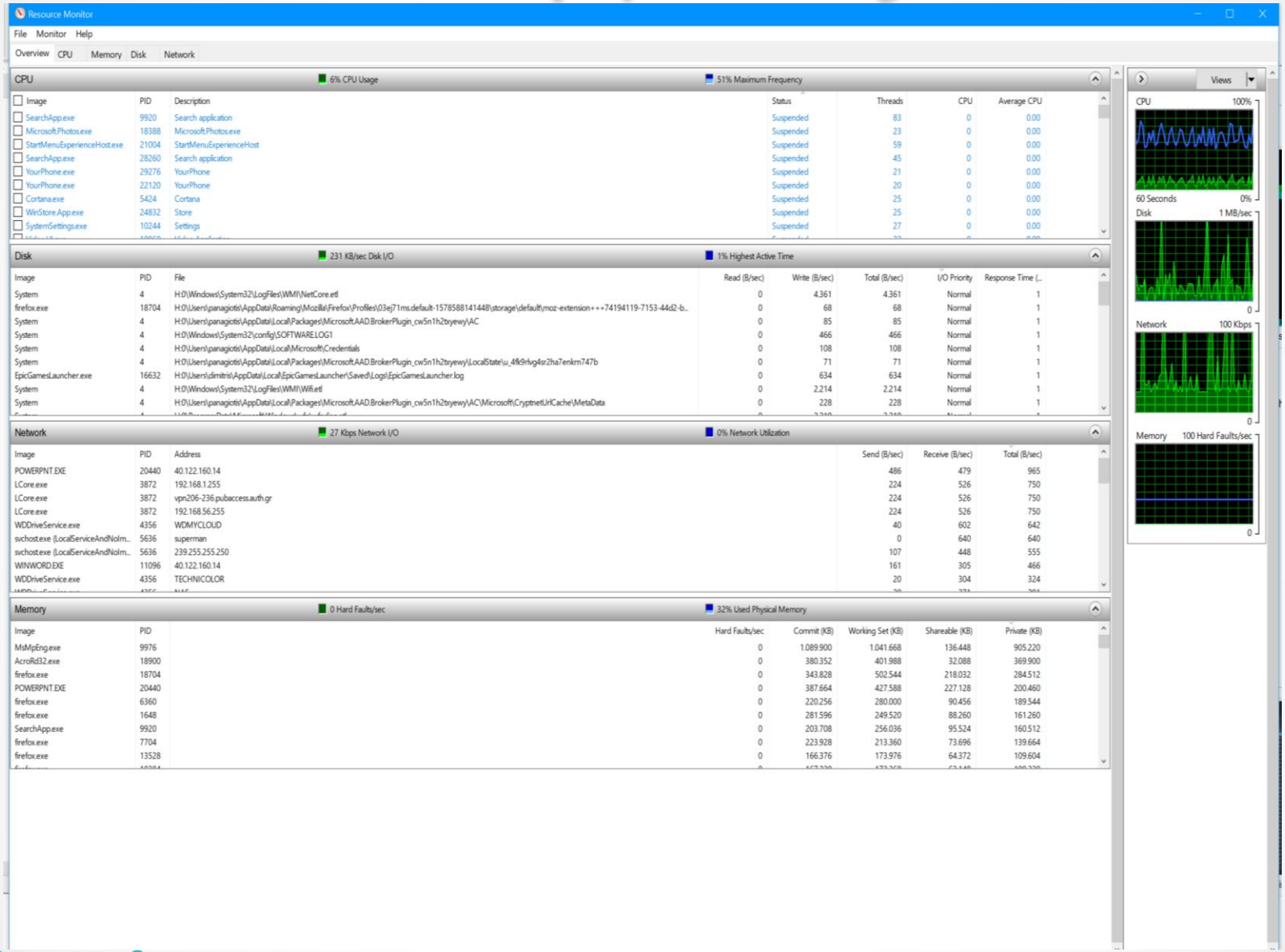
Processes | Performance | App history | Startup | Users | Details | Services

Name	PID	Description	Status	Group
AarSvc		Agent Activation Runtime	Stopped	AarSvcGroup
AarSvc_502ca01f	16836	Agent Activation Runtime_502ca01f	Running	AarSvcGroup
AarSvc_503aa22e		Agent Activation Runtime_503aa22e	Stopped	AarSvcGroup
AdobeARMservice	4240	Adobe Acrobat Update Service	Running	
AdobeFlashPlayerUpdateSvc		Adobe Flash Player Update Service	Stopped	
AJRouter		AllJoyn Router Service	Stopped	LocalServiceNetworkRestricted
ALG		Application Layer Gateway Service	Stopped	
AppIDSvc		Application Identity	Stopped	LocalServiceNetworkRestricted
Appinfo	18288	Application Information	Running	netsvcs
AppMgmt		Application Management	Stopped	netsvcs
AppReadiness		App Readiness	Stopped	AppReadiness
AppVClient		Microsoft App-V Client	Stopped	
AppXSvc	18144	AppX Deployment Service (AppXSVC)	Running	wsappx
aspnet_state		ASP.NET State Service	Stopped	
AssignedAccessManagerSvc		AssignedAccessManager Service	Stopped	AssignedAccessManagerSvc
AtherosSvc	4276	AtherosSvc	Running	
AudioEndpointBuilder	2588	Windows Audio Endpoint Builder	Running	LocalSystemNetworkRestricted
Audiosrv	3280	Windows Audio	Running	LocalServiceNetworkRestricted
autotimesvc		Cellular Time	Stopped	autoTimeSvc
AxInstSV		ActiveX Installer (AxInstSV)	Stopped	AxInstSVGroup
BcastDVRUserService		GameDVR and Broadcast User Service	Stopped	BcastDVRUserService
BcastDVRUserService_502ca01f		GameDVR and Broadcast User Service_502ca01f	Stopped	BcastDVRUserService
BcastDVRUserService_503aa22e		GameDVR and Broadcast User Service_503aa22e	Stopped	BcastDVRUserService
BDESVC		BitLocker Drive Encryption Service	Stopped	netsvcs
BFE	3908	Base Filtering Engine	Running	LocalServiceNoNetworkFirewall

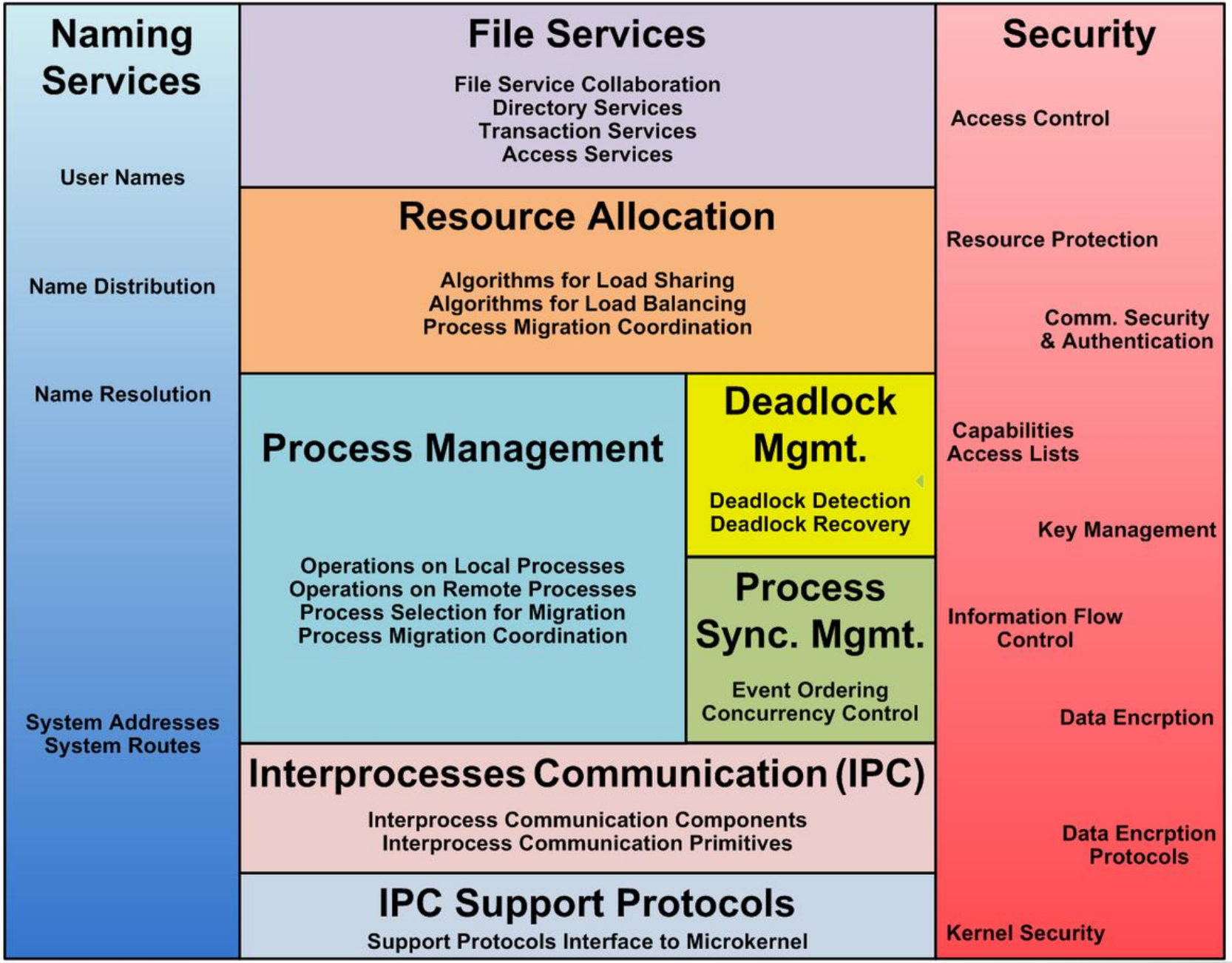
Διεργασίες


Task Manager
File Options View
Processes Performance App history Startup Users Details Services
CPU
10% 2,24 GHz
Memory
11,1/32,0 GB (35%)
Disk 0 (C:)
SSD
0%
Disk 1 (D:)
HDD
0%
Disk 2 (F:)
HDD
0%
Disk 3 (G:)
USB
0%
Disk 4 (I:)
USB
0%
Disk 5 (K:)
Removable
0%
Disk 6 (L:)
Removable
0%
Disk 7 (M:)
Removable
0%
Disk 8 (N:)
Removable
0%
Disk 9 (H:)
USB
0%
Disk 11 (P:)
Removable
0%
Ethernet
Ethernet
S: 0,1 R: 8,7 Mbps
Ethernet
Ethernet 2
S: 0 R: 0 Kbps
GPU 0
NVIDIA GeForce GTX 1050 Ti
5% (41 °C)
Memory
32,0 GB DDR3
Memory usage
32,0 GB
60 seconds
0
Memory composition
In use (Compressed)
10,6 GB (14,8 MB)
Available
20,9 GB
Committed
17,3/36,7 GB
Cached
16,4 GB
Paged pool
1,2 GB
Non-paged pool
921 MB
Speed:
1600 MHz
Slots used:
4 of 4
Form factor:
DIMM
Hardware reserved:
39,2 MB
Fewer details
Open Resource Monitor

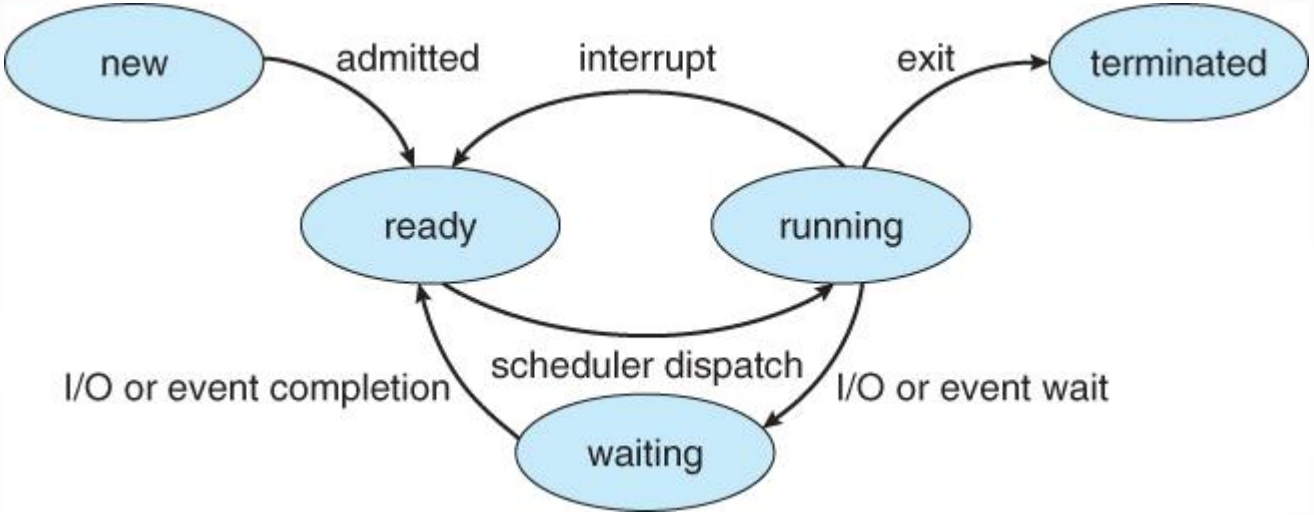
Διεργασίες


Resource Monitor
File Monitor Help
Overview CPU Memory Disk Network
CPU
6% CPU Usage
51% Maximum Frequency
Image PID Description Status Threads CPU Average CPU
SearchApp.exe 9920 Search application Suspended 83 0 0.00
Microsoft.Photos.exe 18388 Microsoft.Photos.exe Suspended 23 0 0.00
StartMenuExperienceHost.exe 21004 StartMenuExperienceHost Suspended 59 0 0.00
SearchApp.exe 28260 Search application Suspended 45 0 0.00
YourPhone.exe 29276 YourPhone Suspended 21 0 0.00
YourPhone.exe 22120 YourPhone Suspended 20 0 0.00
Cortana.exe 5424 Cortana Suspended 25 0 0.00
WinStore.App.exe 24832 Store Suspended 25 0 0.00
SystemSettings.exe 10244 Settings Suspended 27 0 0.00
Disk
231 KB/sec Disk I/O
1% Highest Active Time
Image PID File Read (B/sec) Write (B/sec) Total (B/sec) I/O Priority Response Time (...
System 4 H:\0\Windows\System32\LogFiles\WMI\NetCore.etl 0 4.361 4.361 Normal 1
firefox.exe 18704 H:\0\Users\panagiotis\AppData\Roaming\Mozilla\Firefox\Profiles\03ej71ms.default-1578588141448\storage\default\moz-extension+++74194119-7153-44d2-b... 0 68 68 Normal 1
System 4 H:\0\Users\panagiotis\AppData\Local\Packages\Microsoft.AAD.BrokerPlugin_cw5n1h2txyewy\AC 0 85 85 Normal 1
System 4 H:\0\Windows\System32\config\SOFTWARE.LOG1 0 466 466 Normal 1
System 4 H:\0\Users\panagiotis\AppData\Local\Microsoft\Credentials 0 108 108 Normal 1
System 4 H:\0\Users\panagiotis\AppData\Local\Packages\Microsoft.AAD.BrokerPlugin_cw5n1h2txyewy\LocalState\u_4fk9rlvg4sr2ha7enkrn747b 0 71 71 Normal 1
EpicGamesLauncher.exe 16632 H:\0\Users\dimitris\AppData\Local\EpicGamesLauncher\Saved\Logs\EpicGamesLauncher.log 0 634 634 Normal 1
System 4 H:\0\Windows\System32\LogFiles\WMI\Wifi.etl 0 2.214 2.214 Normal 1
System 4 H:\0\Users\panagiotis\AppData\Local\Packages\Microsoft.AAD.BrokerPlugin_cw5n1h2txyewy\AC\Microsoft\CryptnetUrlCache\MetaData 0 228 228 Normal 1
Network
27 Kbps Network I/O
0% Network Utilization
Image PID Address Send (B/sec) Receive (B/sec) Total (B/sec)
POWERPNT.EXE 20440 40.122.160.14 486 479 965
LCore.exe 3872 192.168.1.255 224 526 750
LCore.exe 3872 vpn206-236.pubaccess.auth.gr 224 526 750
LCore.exe 3872 192.168.56.255 224 526 750
WDDriveService.exe 4356 WDMYCLOUD 40 602 642
svchost.exe (LocalServiceAndNoIm... 5636 superman 0 640 640
svchost.exe (LocalServiceAndNoIm... 5636 239.255.255.250 107 448 555
WINWORD.EXE 11096 40.122.160.14 161 305 466
WDDriveService.exe 4356 TECHNICOLOR 20 304 324
Memory
0 Hard Faults/sec
32% Used Physical Memory
Image PID Hard Faults/sec Commit (KB) Working Set (KB) Shareable (KB) Private (KB)
MsMpEng.exe 9976 0 1.089.900 1.041.668 136.448 905.220
AcroRd32.exe 18900 0 380.352 401.988 32.088 369.900
firefox.exe 18704 0 343.828 502.544 218.032 284.512
POWERPNT.EXE 20440 0 387.664 427.588 227.128 200.460
firefox.exe 6360 0 220.256 280.000 90.456 189.544
firefox.exe 1648 0 281.596 249.520 88.260 161.260
SearchApp.exe 9920 0 203.708 256.036 95.524 160.512
firefox.exe 7704 0 223.928 213.360 73.696 139.664
firefox.exe 13528 0 166.376 173.976 64.372 109.604
Views
CPU 100%
60 Seconds 0%
Disk 1 MB/sec
Network 100 Kbps
Memory 100 Hard Faults/sec

Δομή – ιεραρχία του ΛΣ



Λειτουργίες : CPU(s) scheduling



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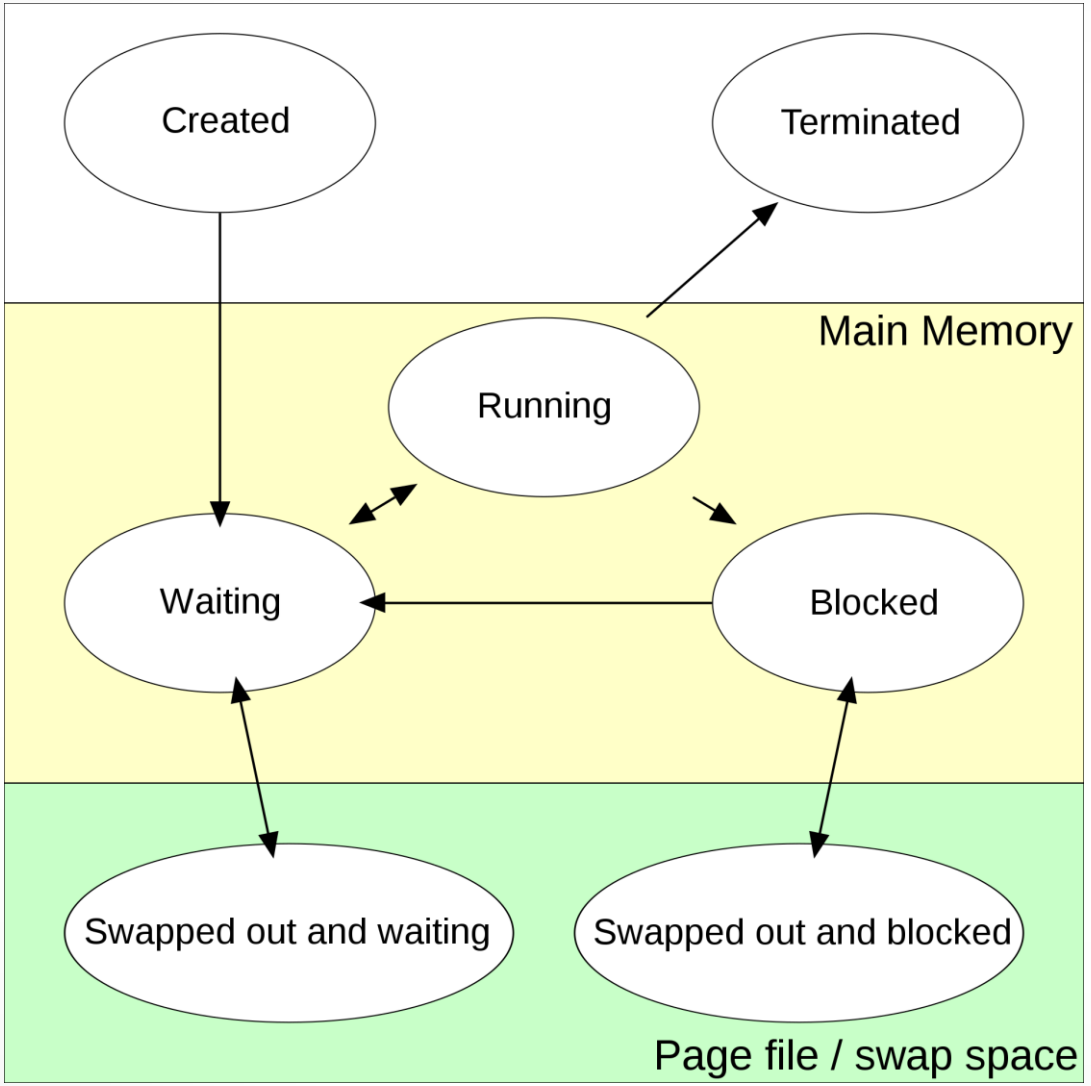
Ο πολυπρογραμματισμός (multiprogramming) και η πολυδιεργασία (multitasking) χρειάζονται έναν αλγόριθμο χρονοπρογραμματισμού (scheduling), ο οποίος έχει στόχο να μεγιστοποιήσει την αποδοτικότητα της CPU με χρήση της όσο το δυνατόν μεγαλύτερο ποσοστό (%) του χρόνου από τις διεργασίες. Όλες οι διεργασίες μοιράζονται την CPU «δίκαια», όπου το δίκαιο καθορίζεται ανάλογα με τα κριτήρια στο συγκεκριμένο ΛΣ/υπολογιστή.

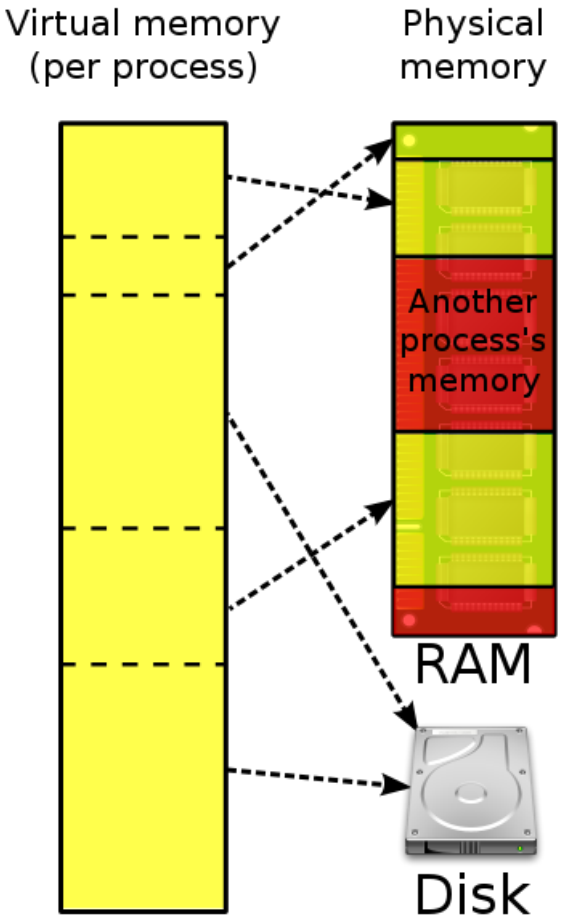




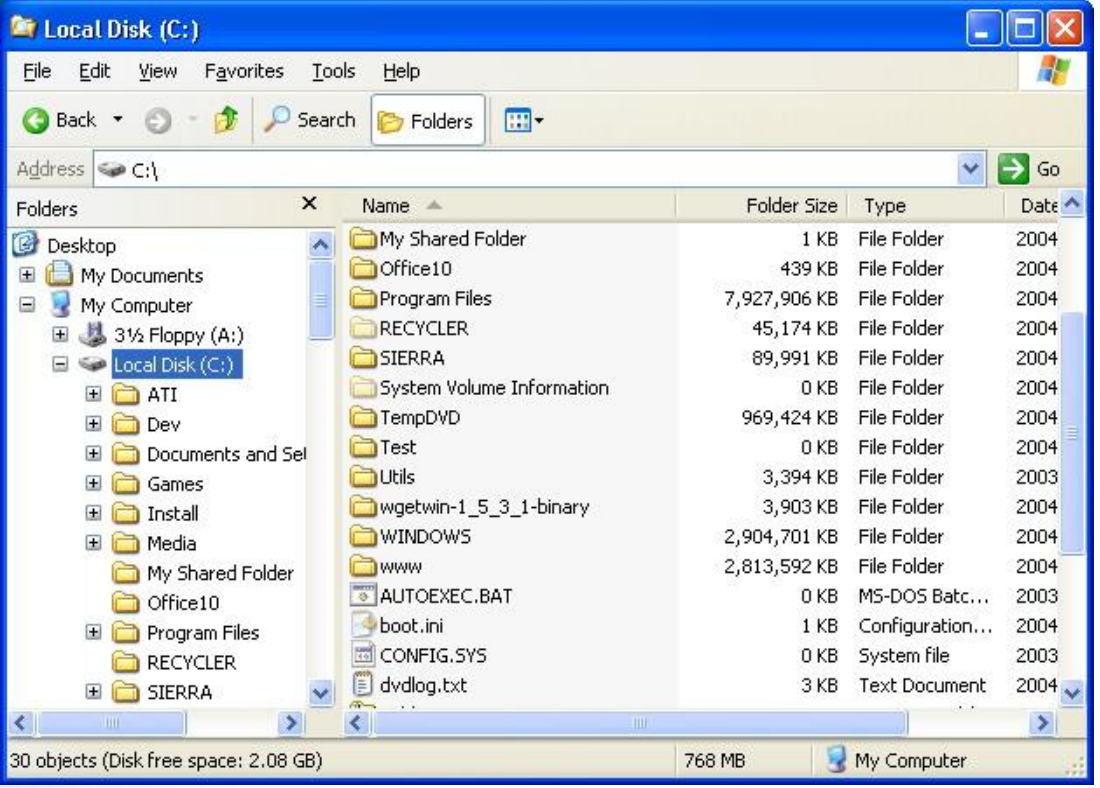
Λειτουργίες : CPU(s) scheduling

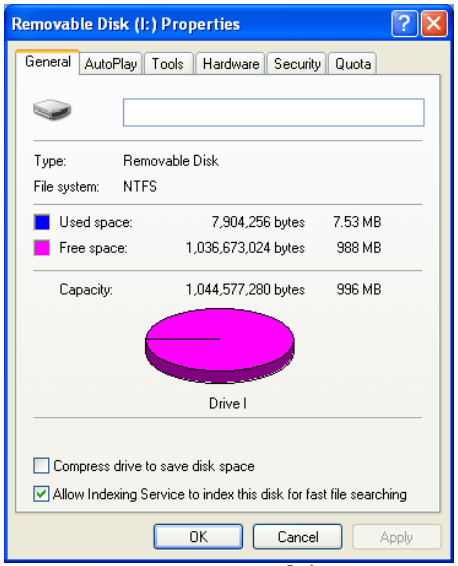


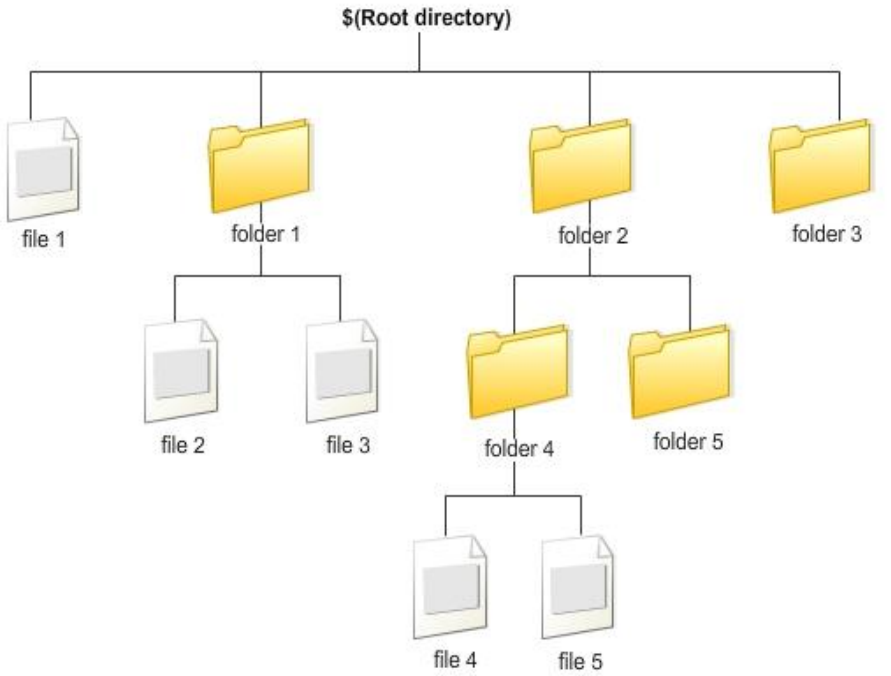
Λειτουργίες : Μνήμη



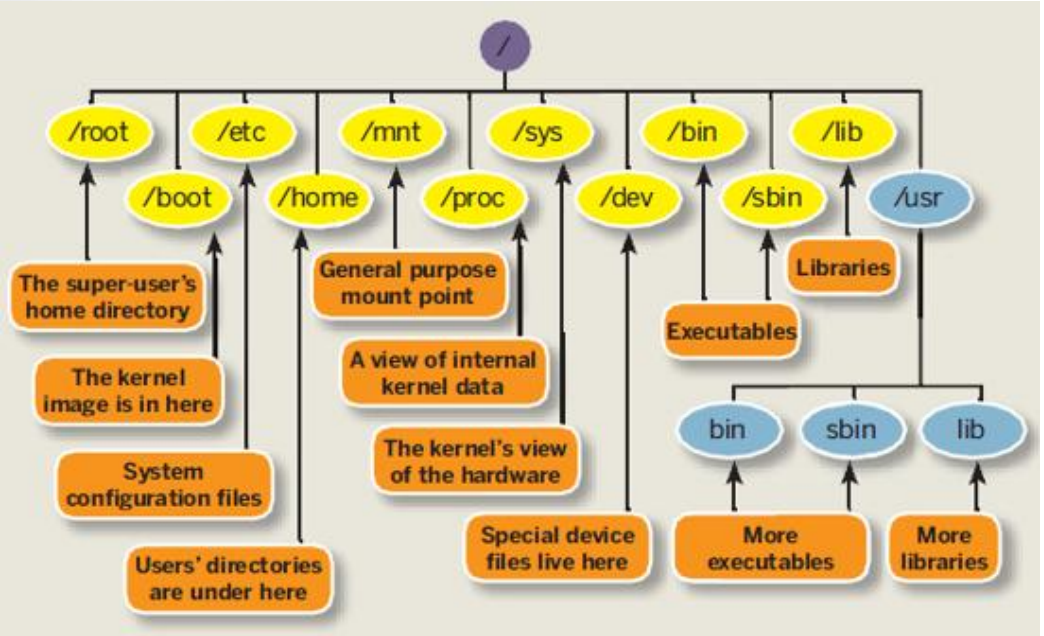
Σύστημα αρχείων
MS Windows style

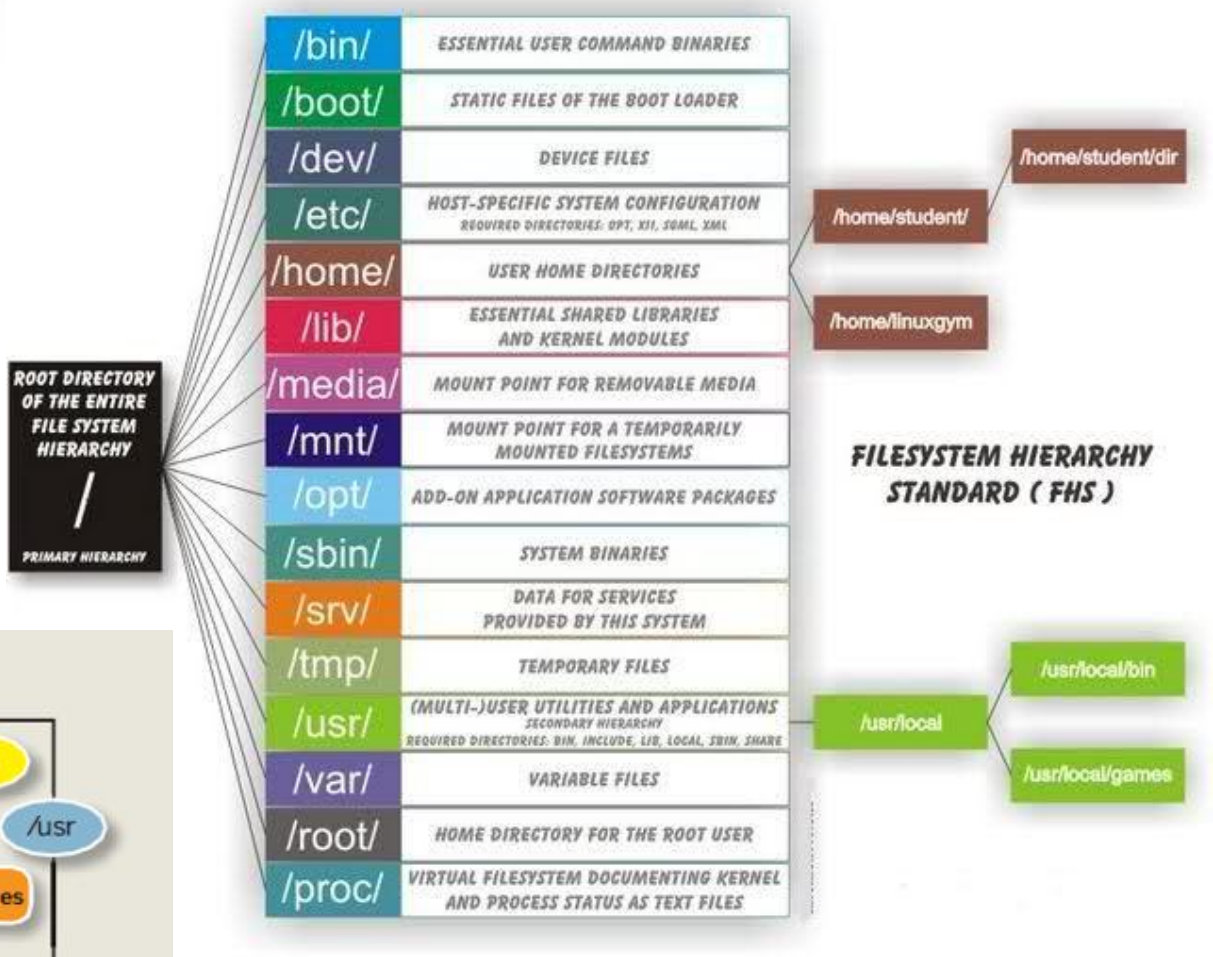






Σύστημα αρχείων (Unix style)





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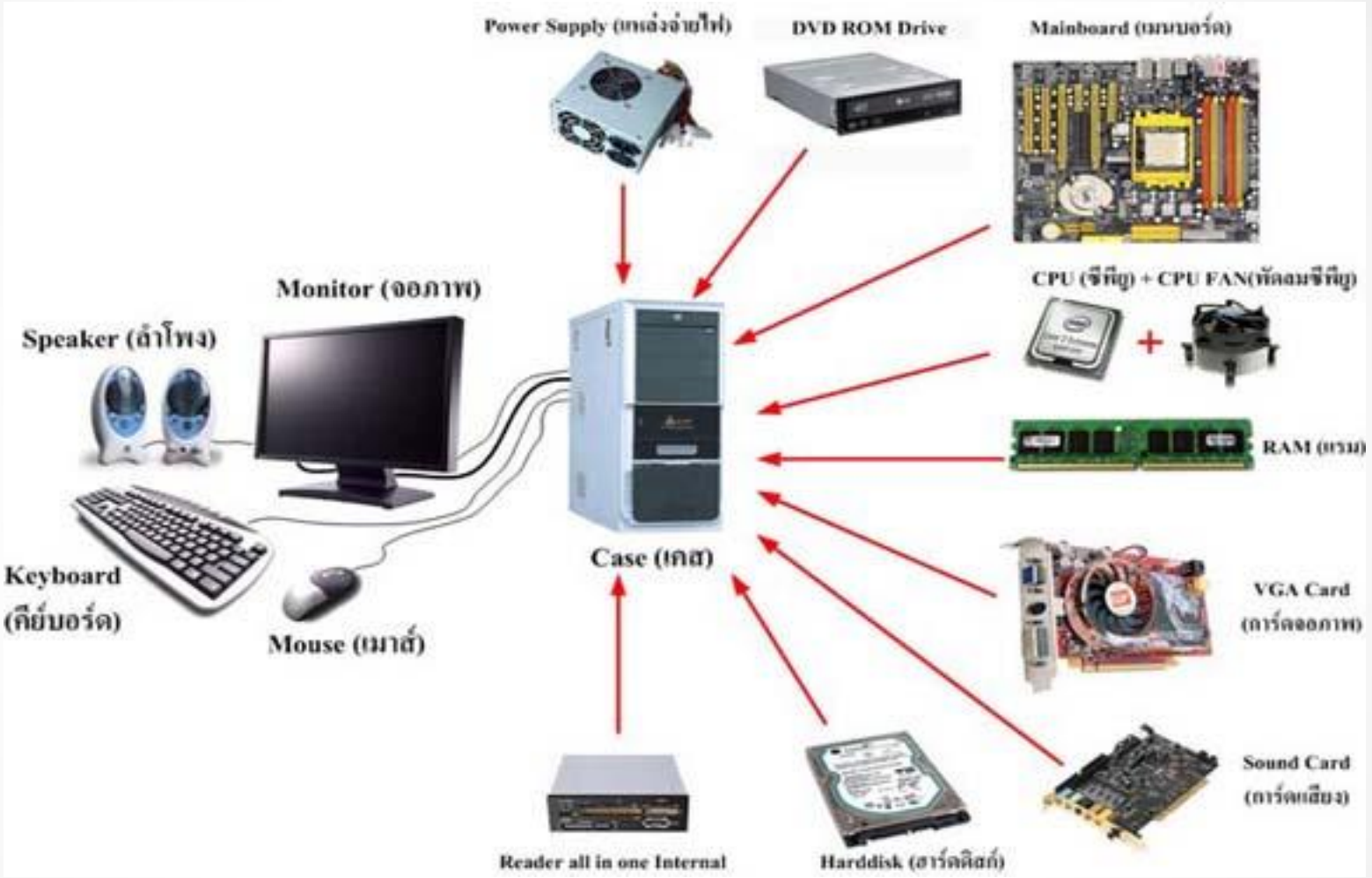
Λειτουργίες εισόδου-εξόδου



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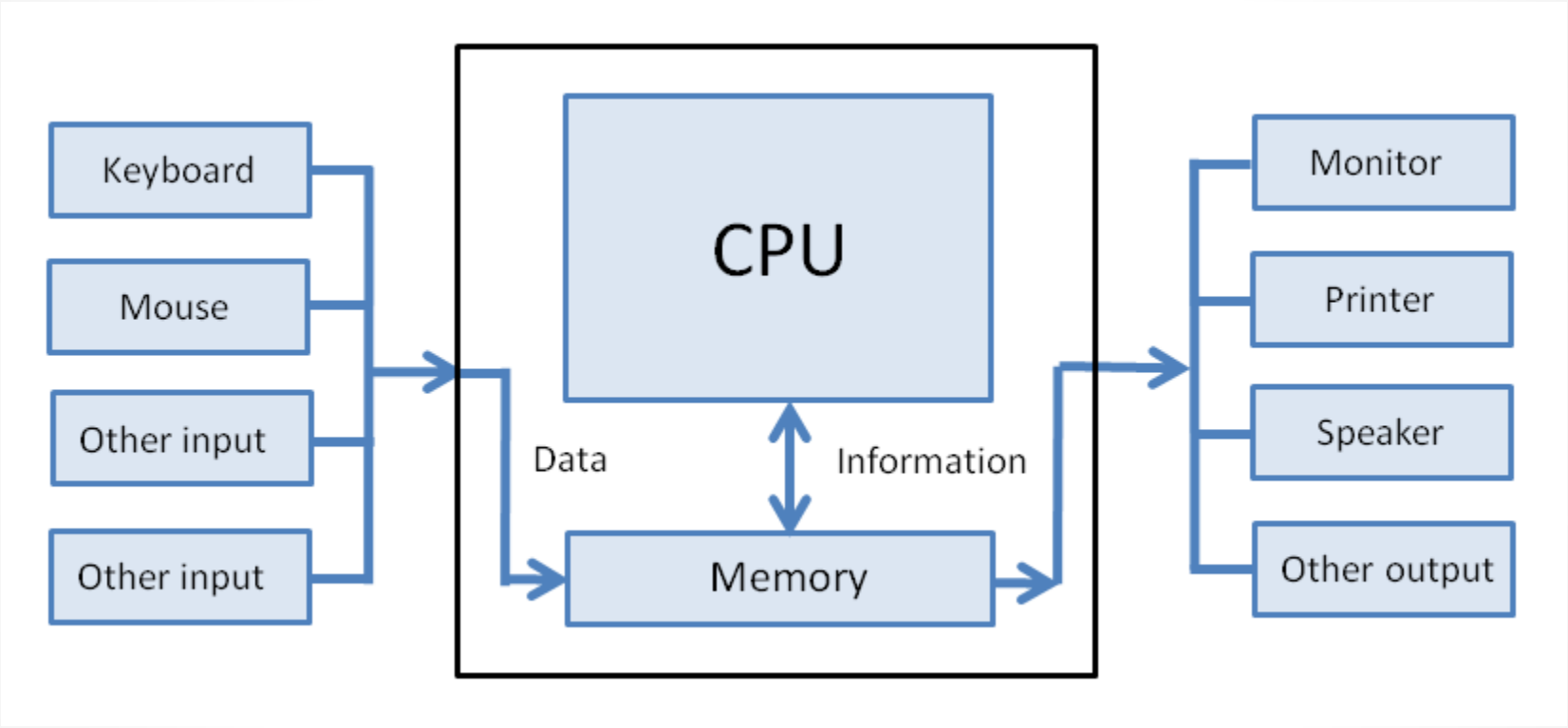
Λειτουργίες εισόδου-εξόδου



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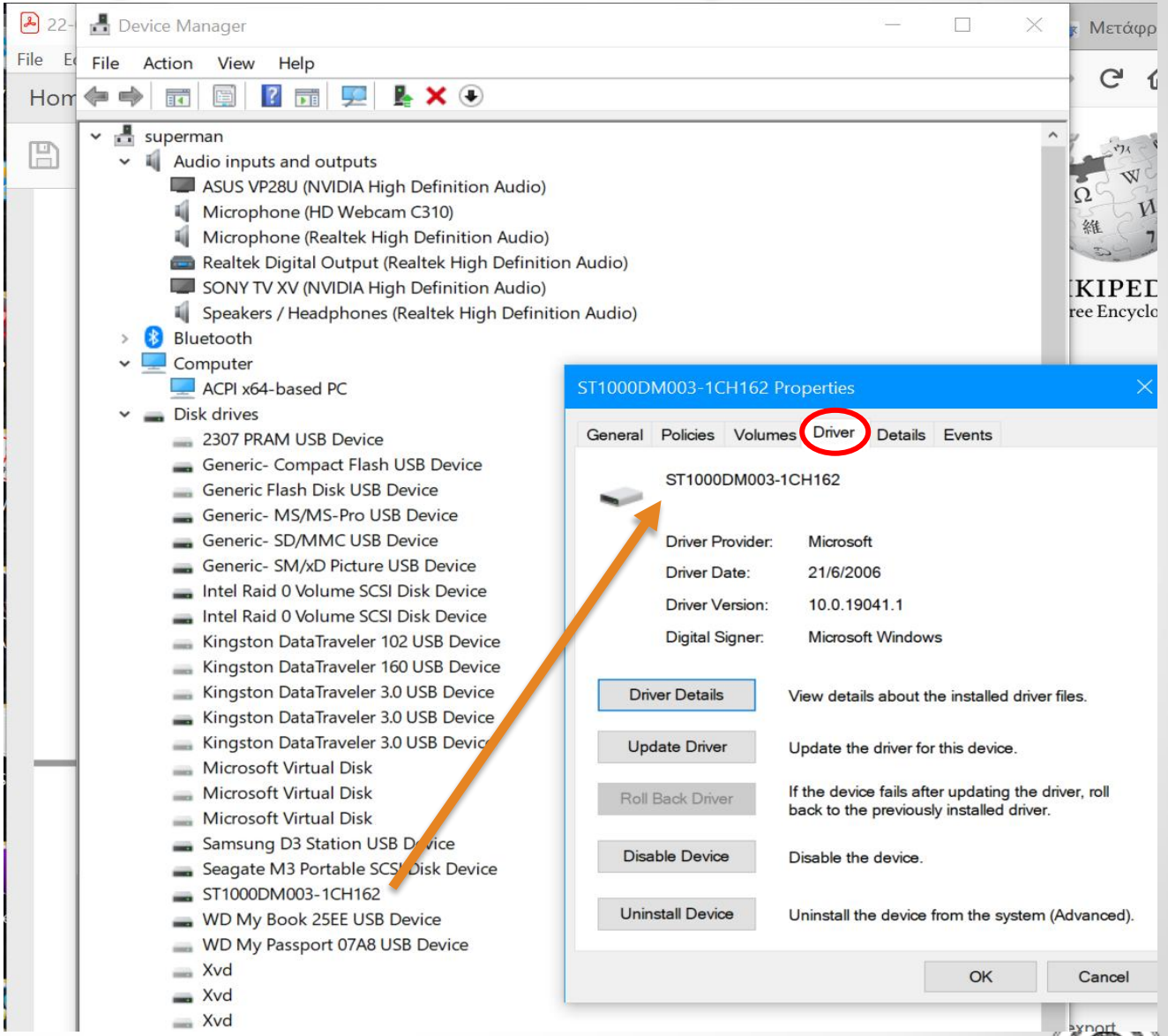
Λειτουργίες εισόδου-εξόδου

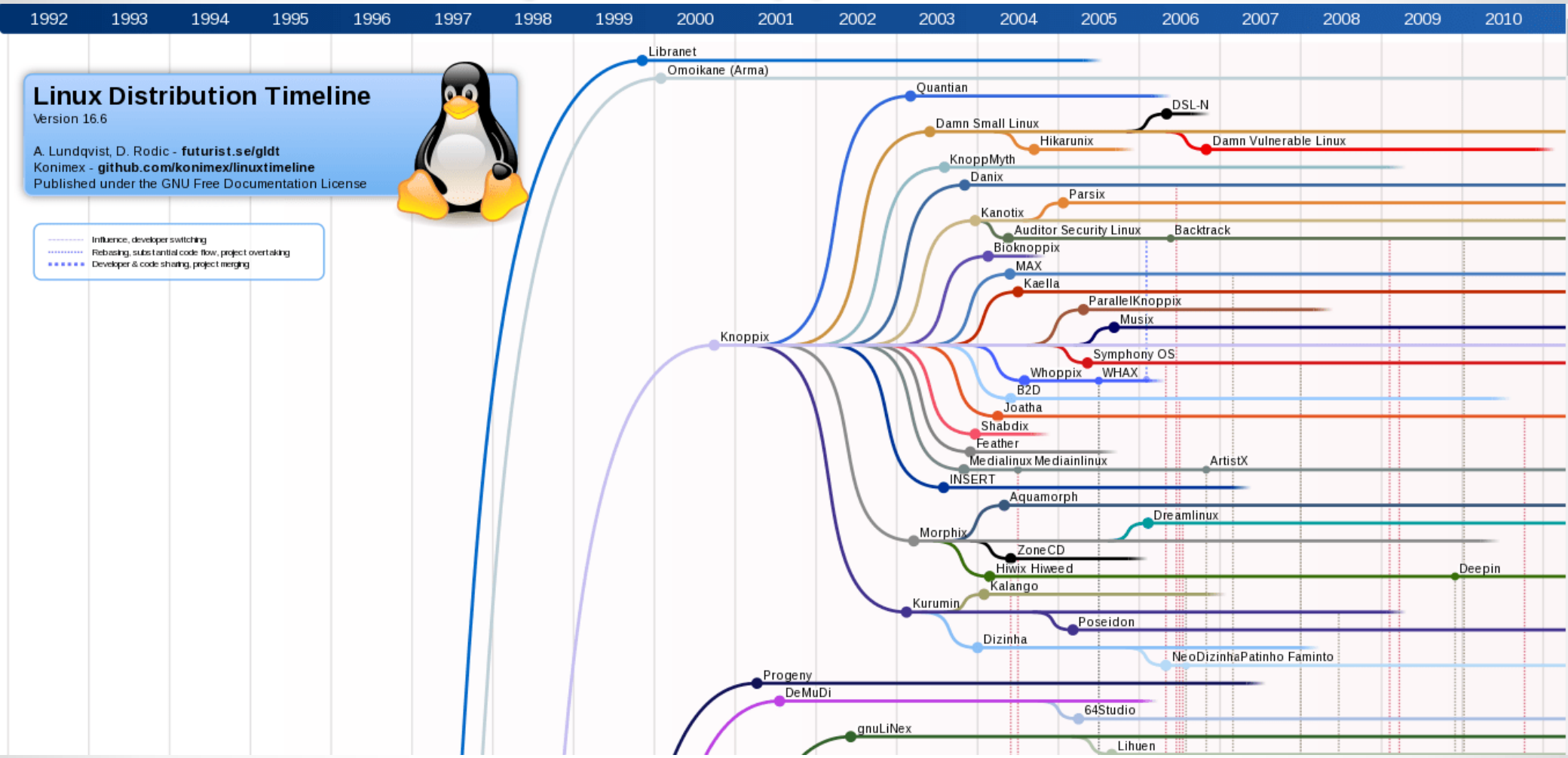
Το ΛΣ διαμεσολαβεί μέσω των προγραμμάτων του οδηγών συσκευών (device drivers).

https://en.wikipedia.org/wiki/Device_driver

https://en.wikipedia.org/wiki/Driver_(software)



Παραδείγματα ΛΣ



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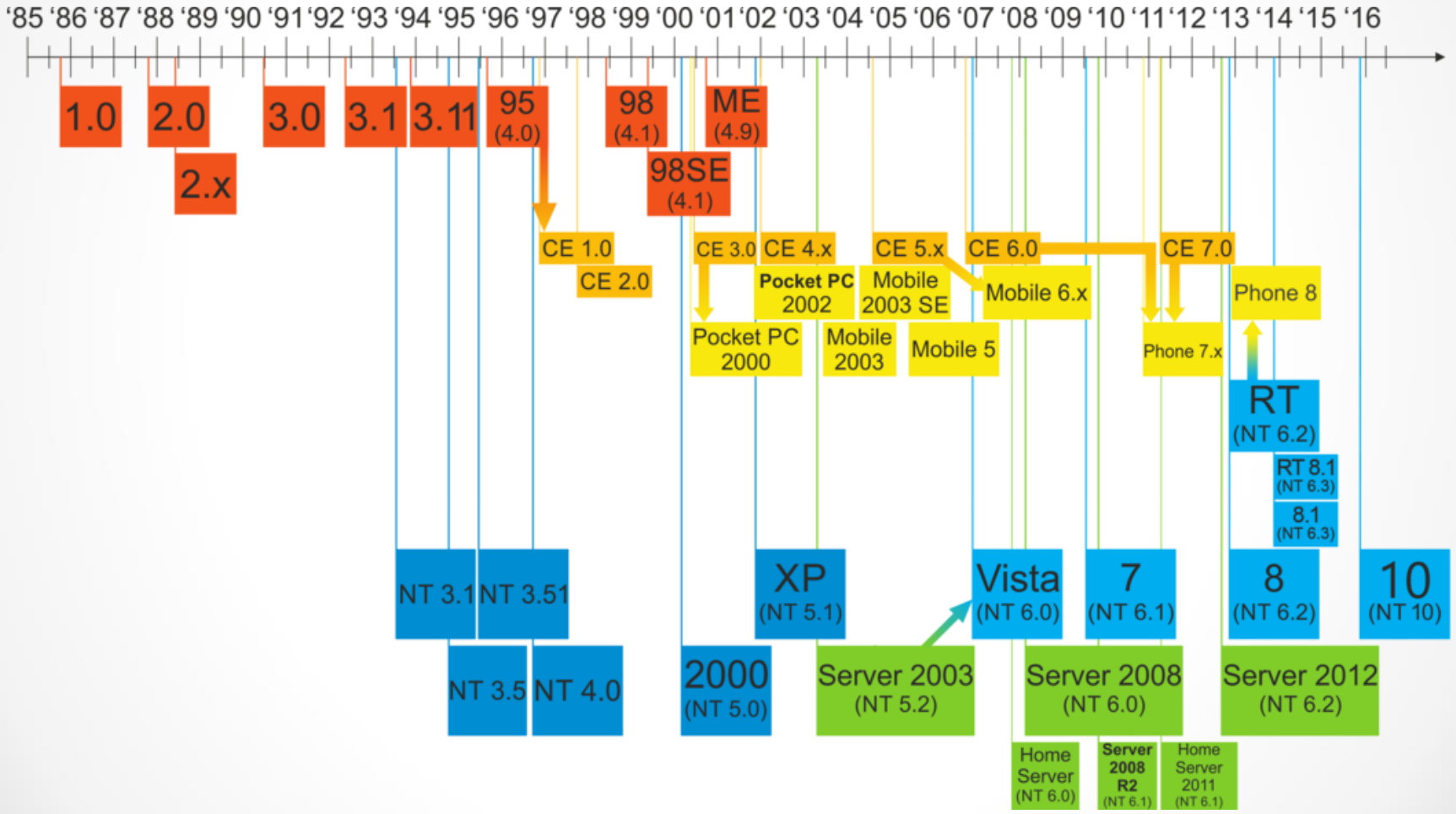
Παραδείγματα ΛΣ
Microsoft Windows



https://en.wikipedia.org/wiki/Microsoft_Windows

Παραδείγματα ΛΣ Android

Version	Marketing name	Release date	API level	Runtime	Launched with
11	11	February 19, 2020	30	ART	Google Pixel 2, Pixel 2 XL, Pixel 3, Pixel 3 XL, Pixel 3a, Pixel 3a XL, Pixel 4, Pixel 4XL[397]
10	10	September 3, 2019	29	ART	Pixel, Pixel XL, Pixel 2, Pixel 2 XL, Pixel 3, Pixel 3 XL, Pixel 3a, Pixel 3a XL[398]
9	Pie	August 6, 2018	28	ART	Essential Phone, Pixel, Pixel XL, Pixel 2, Pixel 2 XL, Nokia 7 Plus, OnePlus 6, Oppo R15 Pro, Sony Xperia XZ2, Vivo X21UD, Vivo X21, Xiaomi Mi Mix 2S[399]
8.1	Oreo	December 5, 2017	27	ART	Pixel, Pixel XL, Nexus 6P, Nexus 5X
8.0		August 21, 2017	26	ART	N/A
7.1	Nougat	October 4, 2016	25	ART	Pixel, Pixel XL
7.0		August 22, 2016	24	ART	Nexus 5X, Nexus 6P
6.0	Marshmallow	October 5, 2015	23	ART	
5.1	Lollipop	March 9, 2015	22	ART	Android One
5.0		November 3, 2014	21	ART 2.1.0	Nexus 6, Nexus 9
4.4	KitKat	October 31, 2013	19	Dalvik (and ART 1.6.0)	Nexus 5
4.3	Jelly Bean	July 24, 2013	18	Dalvik	Nexus 7 2013
4.2		November 13, 2012	17	Dalvik	Nexus 4, Nexus 10
4.1		July 9, 2012	16	Dalvik	Nexus 7
4.0	Ice Cream Sandwich	October 19, 2011	15	Dalvik	Galaxy Nexus
2.3	Gingerbread	February 9, 2011	10	Dalvik 1.4.0	Nexus S

https://en.wikipedia.org/wiki/Android_(operating_system)





Παραδείγματα ΛΣ MacOS

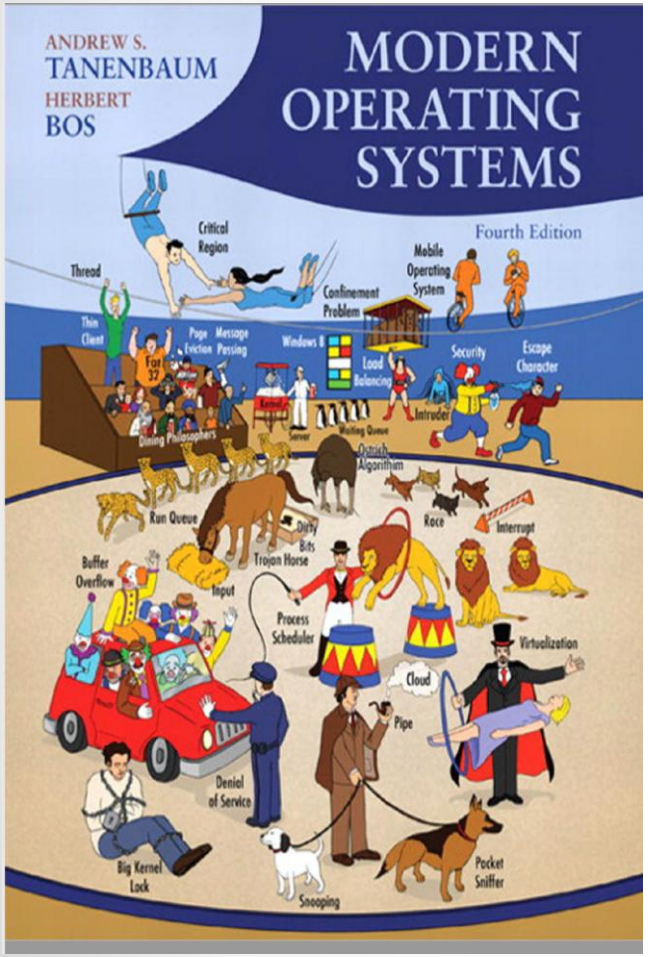
Mac OS X, OS X, and macOS version information

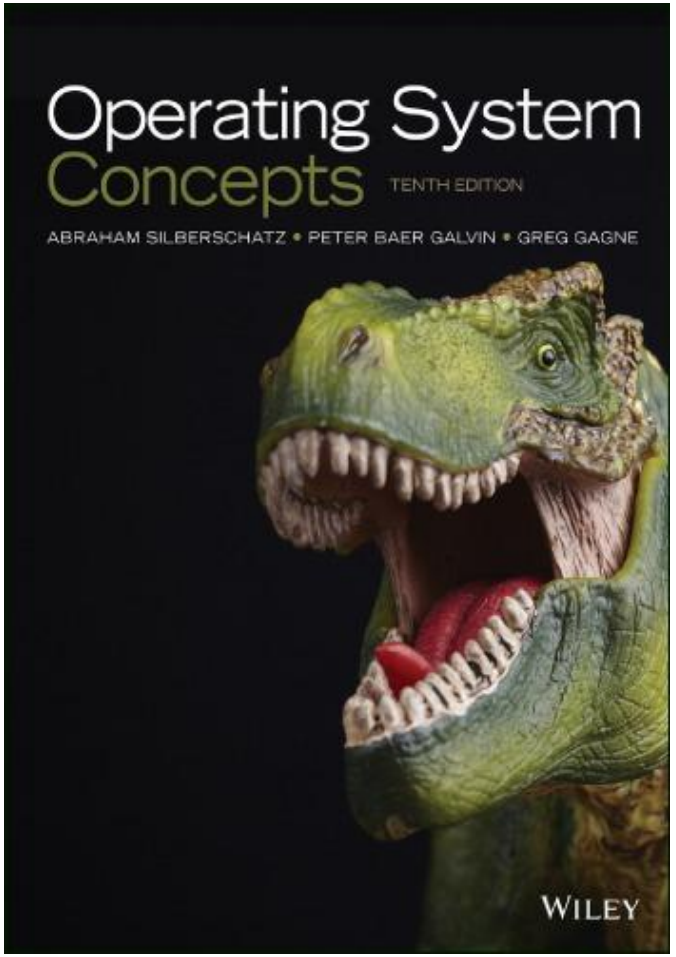
Version	Codename	Darwin version	Processor support	Application support	Kernel	Date announced	Release date	End of support date	Most recent version
Rhapsody Developer Release	Grail1Z4 / Titan1U		32-bit PowerPC	32-bit PowerPC	32-bit	January 7, 1997[159]	August 31, 1997	Unknown	DR2 (May 14, 1998)
Mac OS X Server 1.0	Hera					Unknown	March 16, 1999	Unknown	1.2v3 (October 27, 2000)
Mac OS X Developer Preview	Unknown					May 11, 1998[160]	March 16, 1999	Unknown	DP4 (April 5, 2000)
Mac OS X Public Beta	Kodiak[161]					May 15, 2000[162]	September 13, 2000	March 24, 2001	N/A
Mac OS X 10.0	Cheetah	1.3.1				January 9, 2001[163]	March 24, 2001	2004	10.0.4 (4Q12) (June 22, 2001)
Mac OS X 10.1	Puma	1.4.1 / 5				July 18, 2001[164]	September 25, 2001	2005	10.1.5 (5S60) (June 6, 2002)
Mac OS X 10.2	Jaguar	6	32/64-bit PowerPC[Note 1]			May 6, 2002[165]	August 24, 2002	2006	10.2.8 (October 3, 2003)
Mac OS X 10.3	Panther	7	32/64-bit PowerPC			June 23, 2003[166]	October 24, 2003	2007	10.3.9 (7W98) (April 15, 2005)
Mac OS X 10.4	Tiger	8	32/64-bit PowerPC and Intel	32/64-bit[Note 2] PowerPC[Note 3] and Intel		May 4, 2004[167]	April 29, 2005	September 2009	10.4.11 (November 14, 2007)
Mac OS X 10.5	Leopard	9		32/64-bit PowerPC[Note 3] and Intel		June 26, 2006[168]	October 26, 2007	June 23, 2011	10.5.8 (9L31a) (August 13, 2009)
Mac OS X 10.6	Snow Leopard	10	32/64-bit Intel	32/64-bit Intel 32-bit PowerPC[Note 3]	32/64-bit[169]	June 9, 2008[170]	August 28, 2009	February 25, 2014	10.6.8 (10K549) (July 25, 2011)
Mac OS X 10.7	Lion	11	64-bit Intel	32/64-bit Intel		October 20, 2010[171]	July 20, 2011	October 2014	10.7.5 (11G63) (October 4, 2012)
OS X 10.8	Mountain Lion	12			64-bit[172]	February 16, 2012[173]	July 25, 2012[174]	September 2015	10.8.5 (12F2560) (August 13, 2015)
OS X 10.9	Mavericks	13				June 10, 2013[175]	October 22, 2013	September 2016	10.9.5 (13F1911) (July 18, 2016)
OS X 10.10	Yosemite	14				June 2, 2014[176]	October 16, 2014	August 2017	10.10.5 (14F2511) (July 19, 2017)
OS X 10.11	El Capitan	15				June 8, 2015[177]	September 30, 2015	September 2018	10.11.6 (15G22010) (July 9, 2018)
macOS 10.12	Sierra	16				June 13, 2016[178]	September 20, 2016	October 2019	10.12.6 (16G2136) (September 26, 2019)
macOS 10.13	High Sierra	17				June 5, 2017	September 25, 2017	November 30, 2020[citation needed]	10.13.6 (17G14019) (July 15, 2020)
macOS 10.14	Mojave	18				June 4, 2018	September 24, 2018	September 2021[citation needed]	10.14.6 (18G6020) (July 15, 2020)
macOS 10.15	Catalina	19		64-bit Intel		June 3, 2019	October 7, 2019	TBA	10.15.6 (19G73) (July 15, 2020)
macOS 11.0	Big Sur	20	64-bit Intel and ARM	64-bit Intel and ARM[Note 4]		June 22, 2020	TBA	TBA	TBA

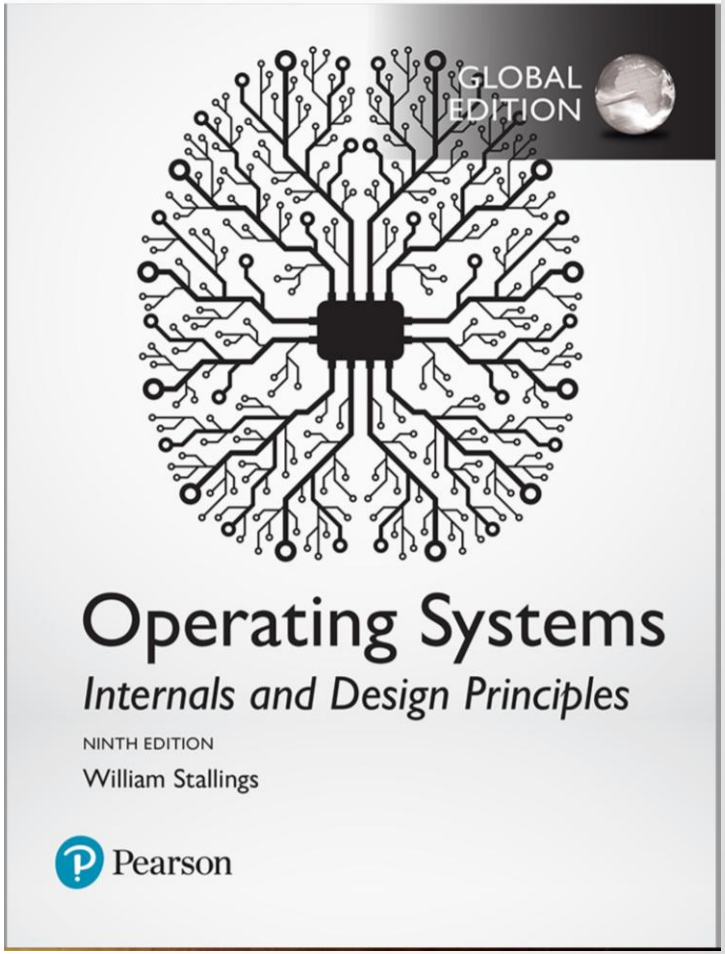
Legend: Old version | Older version, still maintained | **Latest version** | Latest preview version | Future release

https://en.wikipedia.org/wiki/MacOS

Παραδείγματα: στη βιβλιογραφία!







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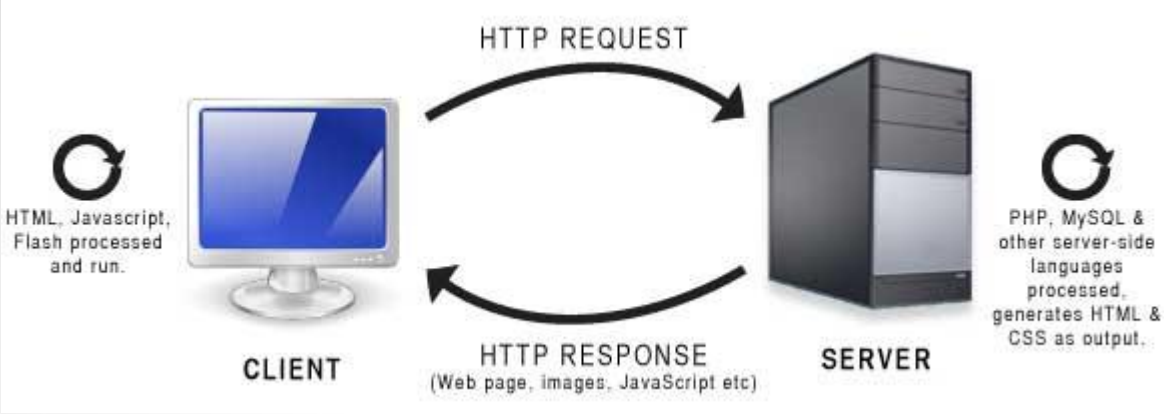

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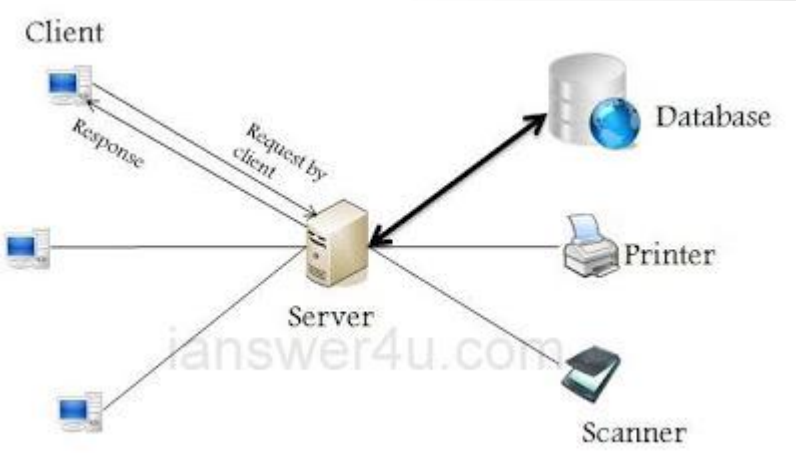

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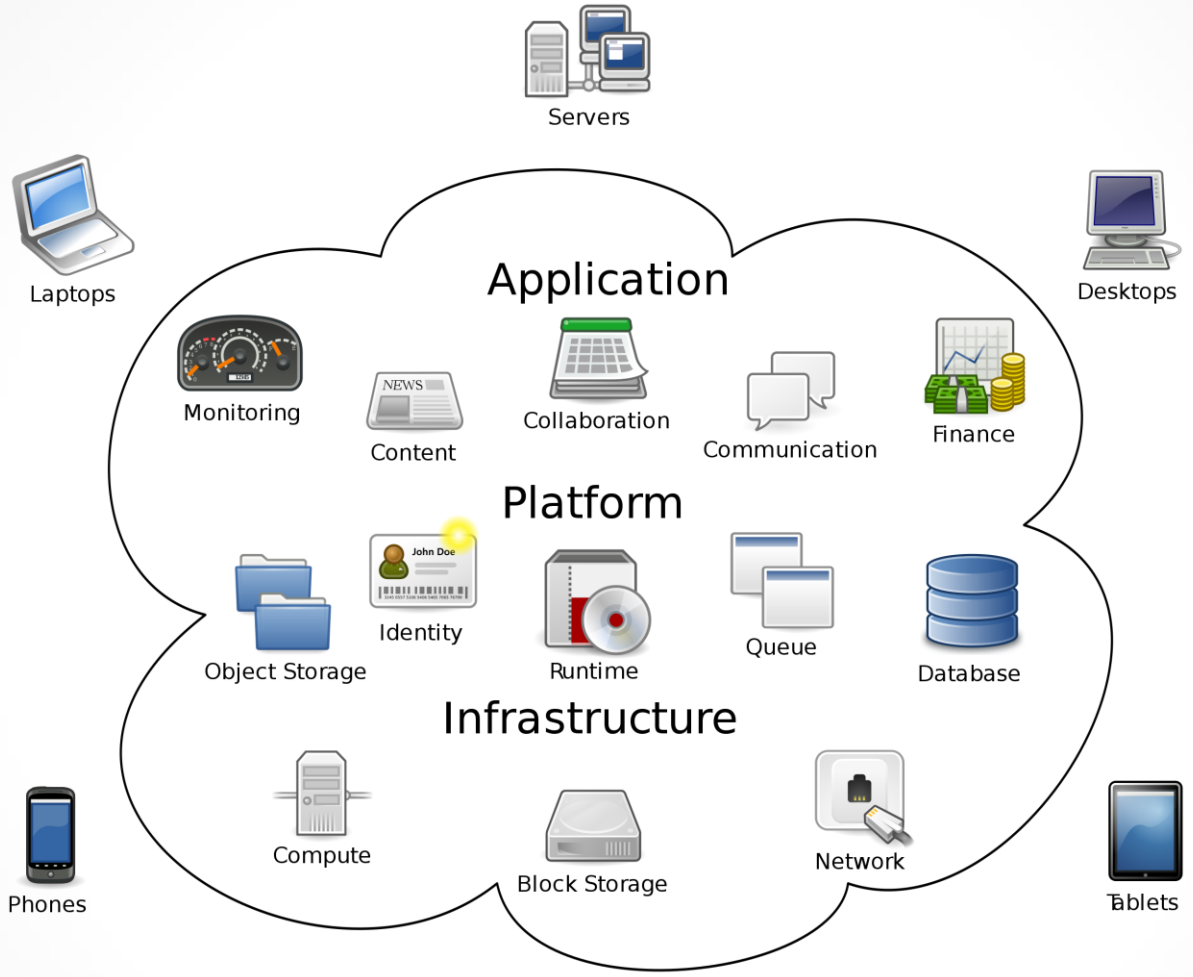
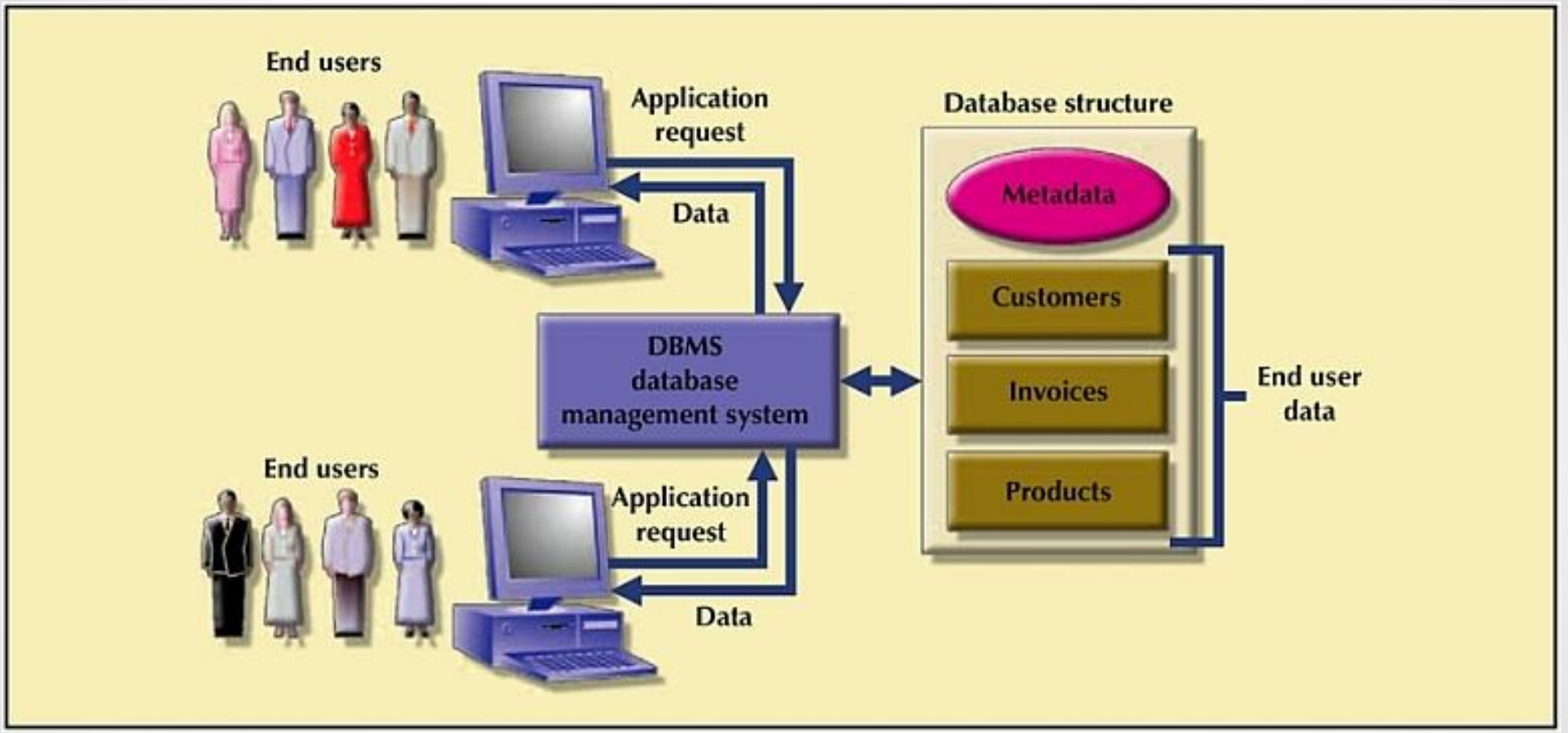
Αρχιτεκτονικές client - server

Πληροφοριακά Συστήματα



https://en.wikipedia.org/wiki/Cloud_computing

Πληροφοριακά Συστήματα



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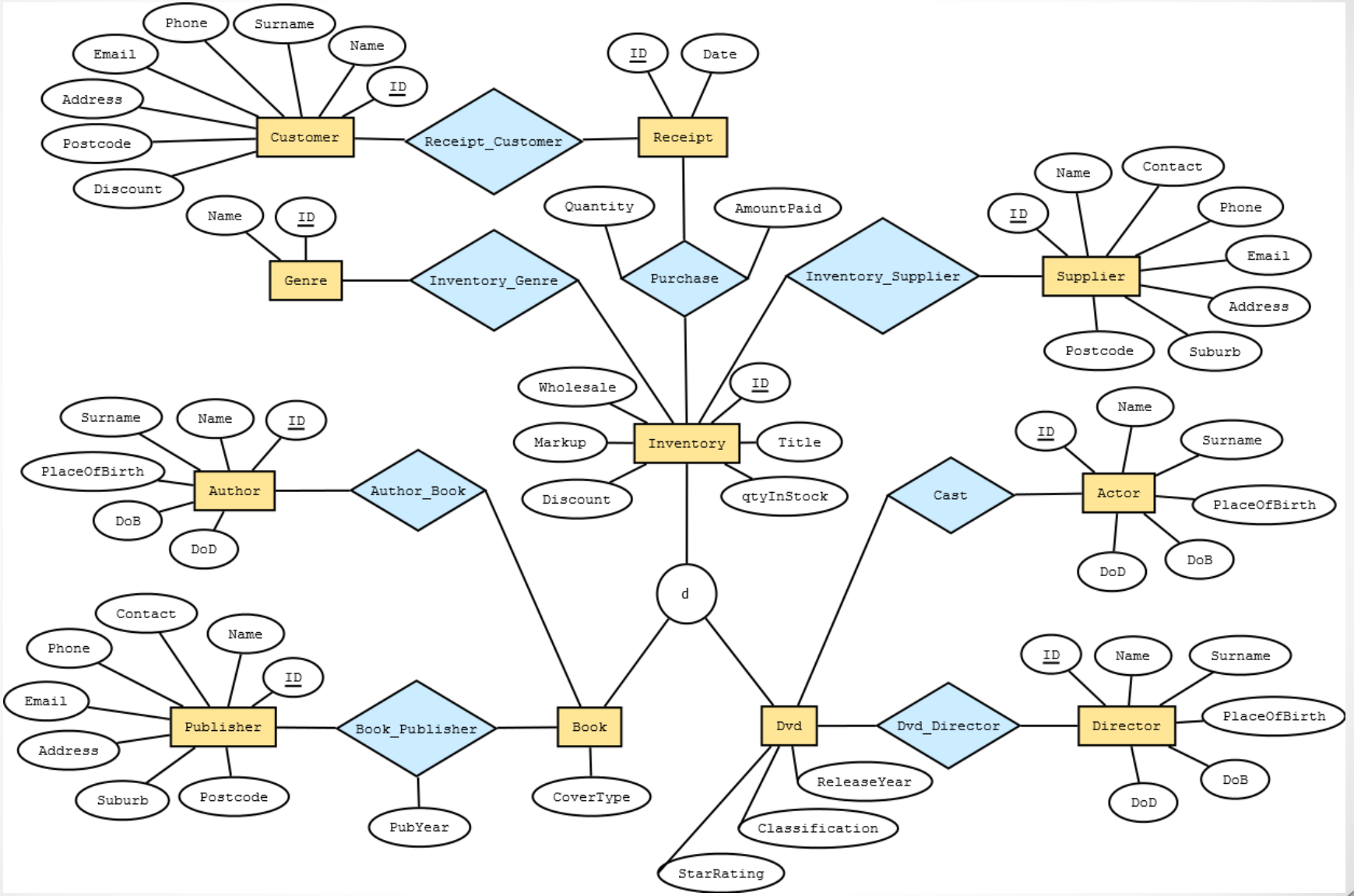

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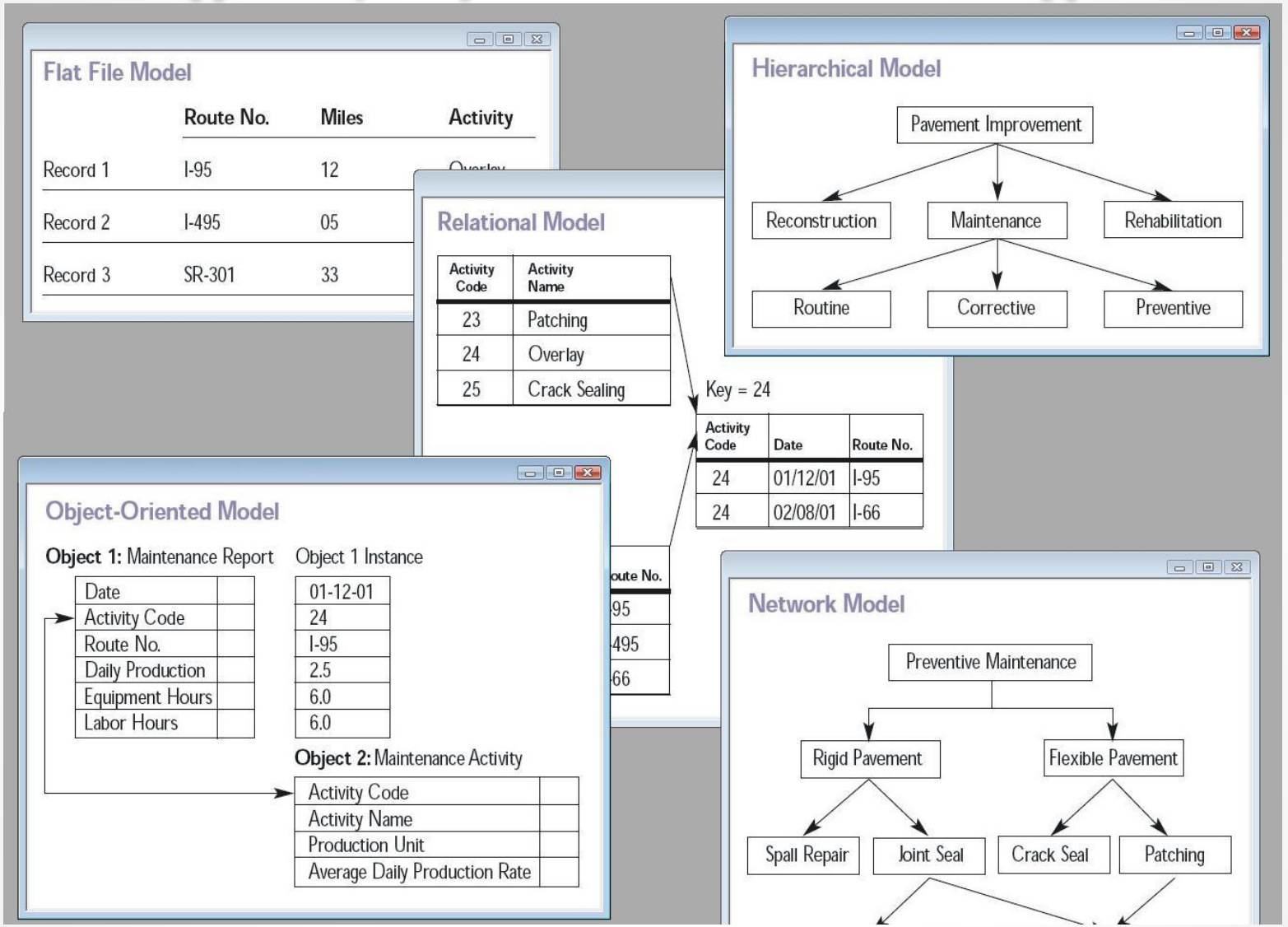
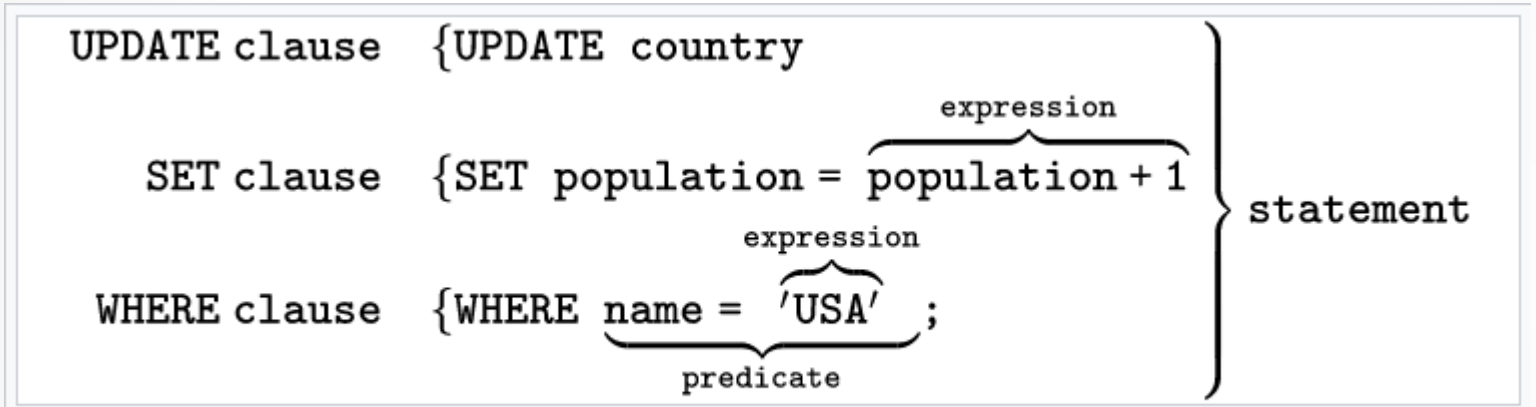


Πληροφοριακά Συστήματα

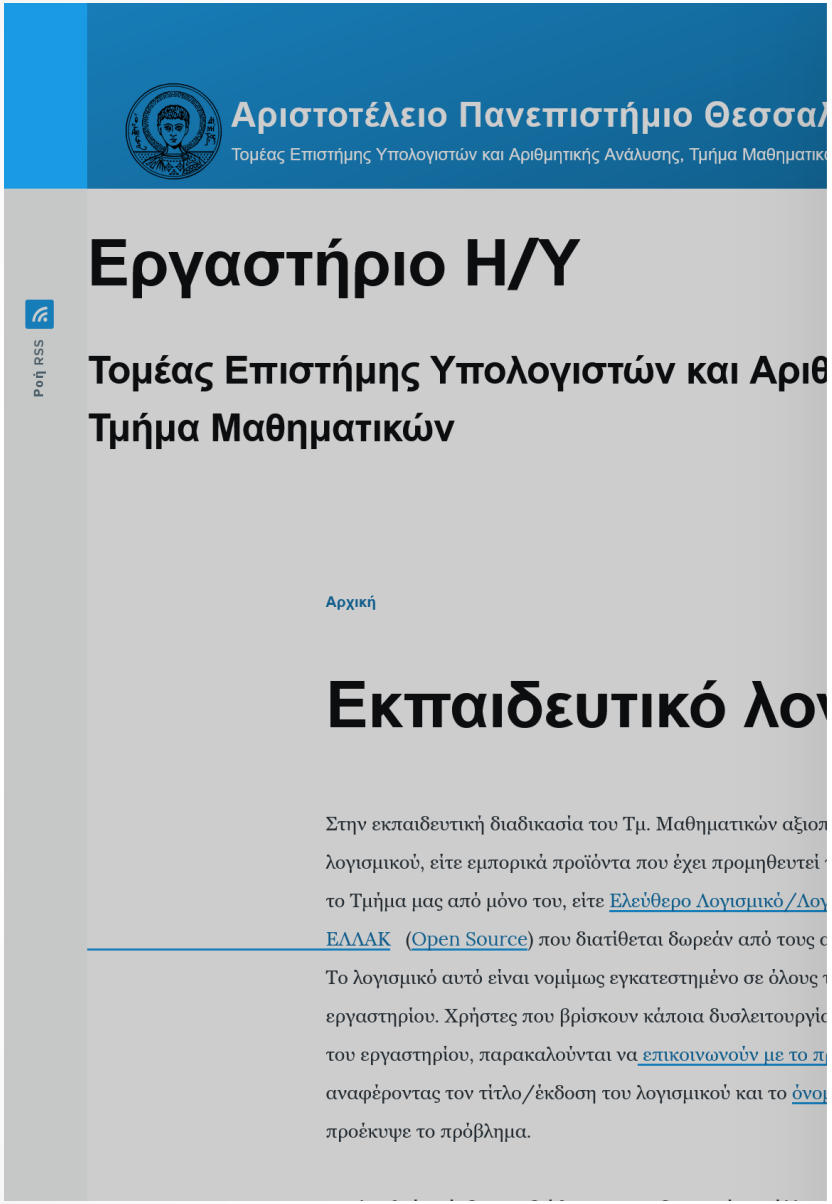
SQL : Structured Query Language

https://en.wikipedia.org/wiki/SQL

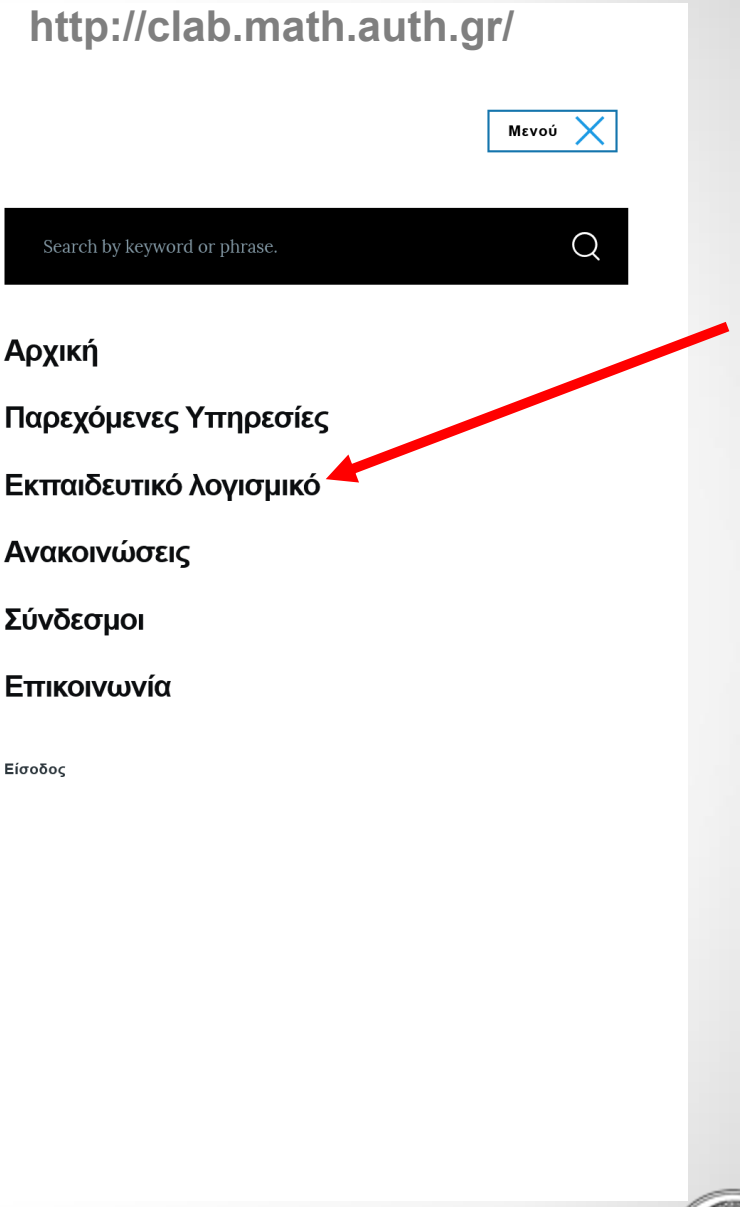


A chart showing several of the SQL language elements that compose a single statement

Εξοικείωση με λογισμικό μαθήματος



http://clab.math.auth.gr/



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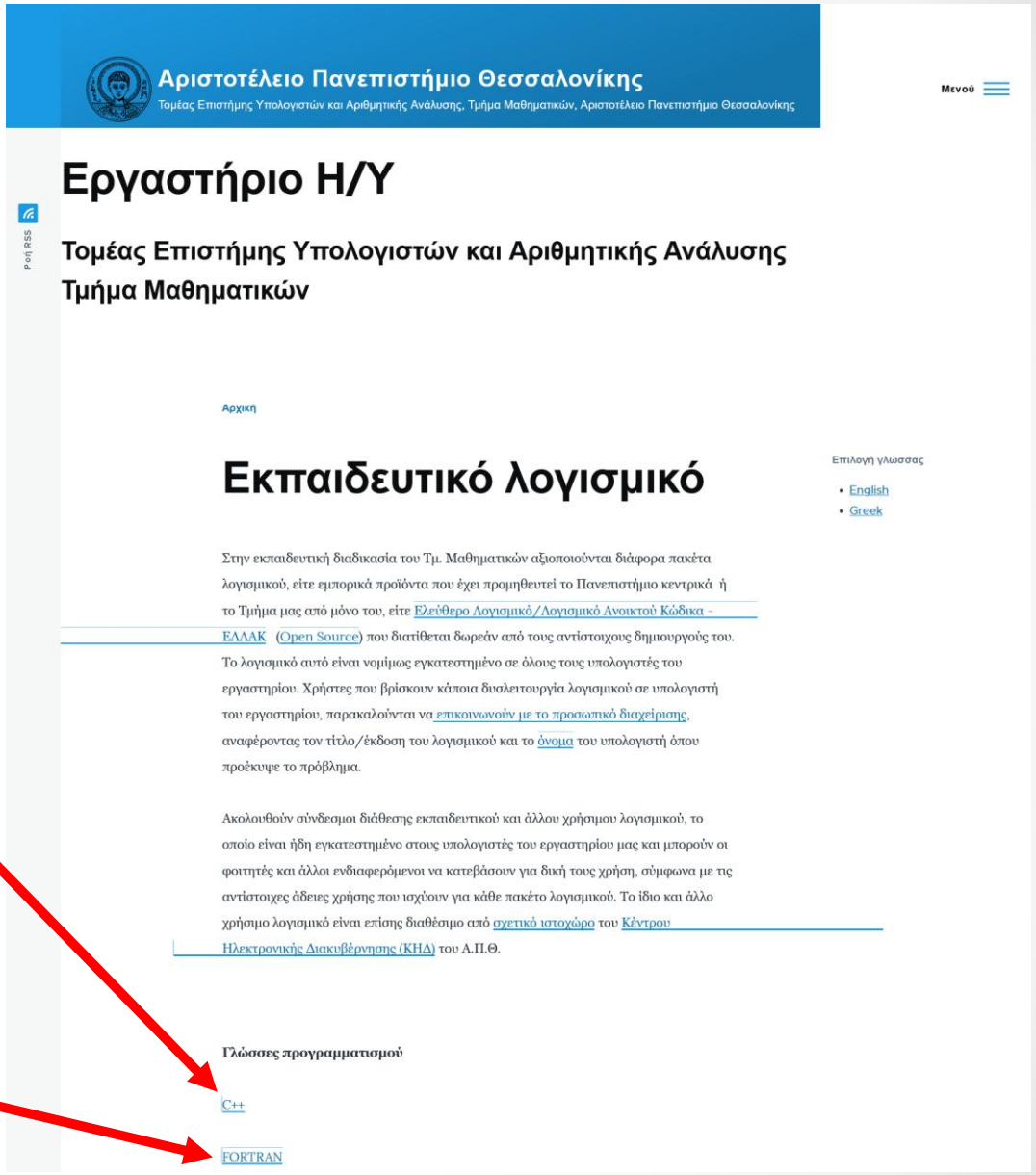
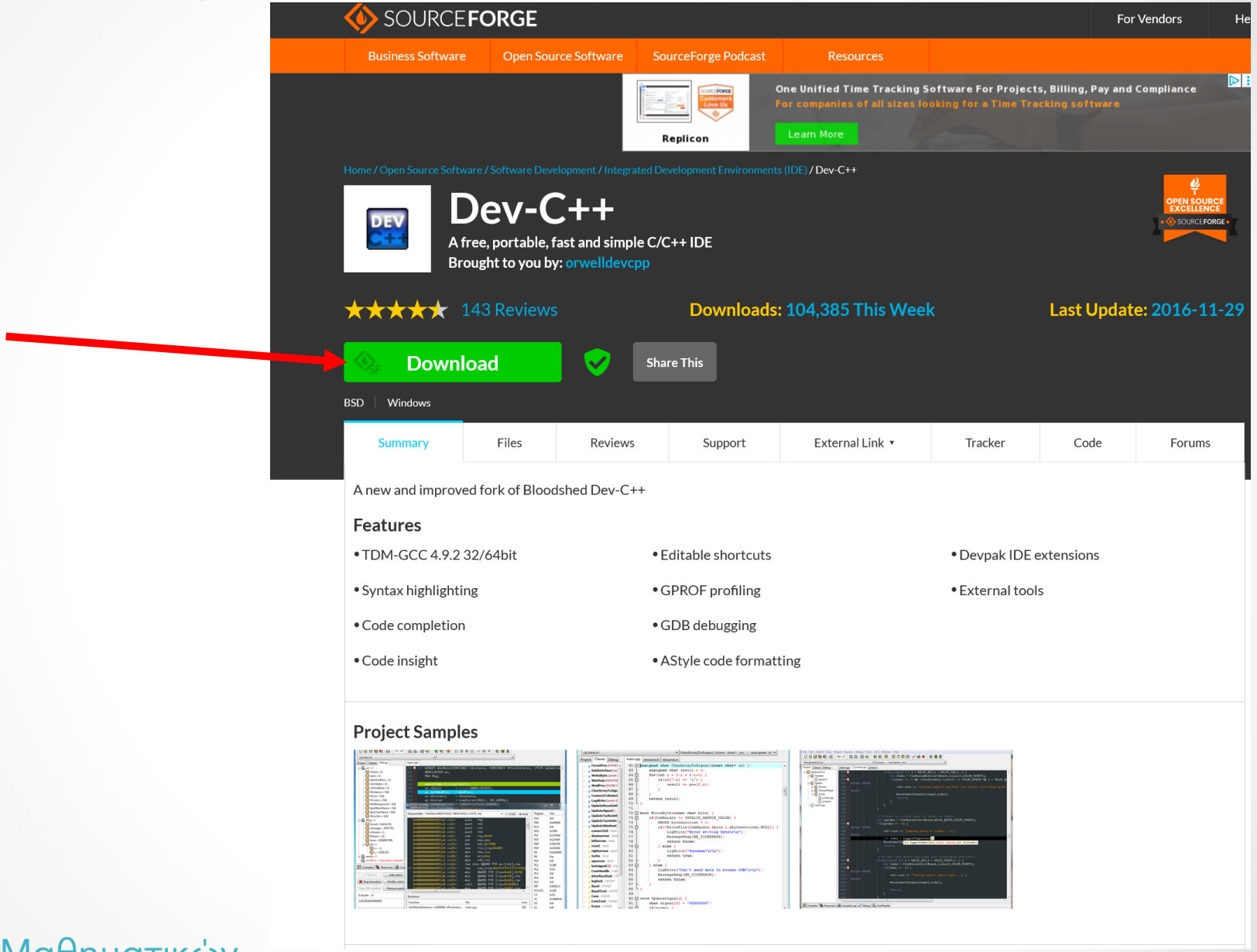


Εξοικείωση με λογισμικό μαθήματος



Εξοικείωση με λογισμικό μαθήματος

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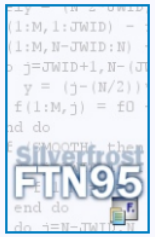
Search

Welcome

Silverfrost Fortran

Welcome to the home of Silverfrost Fortran FTN95. We let you use Fortran *your way:*



- **Traditional** - Use Silverfrost Fortran from the command line or from your favourite editor the way nature intended
- **Included** - Use Silverfrost Fortran with the powerful Plato IDE -- included with all versions of FTN95
- **Bug Killing** - Our famous CHECKMATE technology keeps those bugs quiet.
- **free graphics** - use Simdem a public domain library built with our Fortran, includes full source code
- **64-bit** - Includes our 64-bit Fortran compiler. Use **all** your PC's memory. Of course the 32-bit compiler is there too.
- **Visual Studio** - Visual Studio plug-ins are provided so you can edit, compile and debug in the world's favourite IDE.
- **with .NET** - FTN95 comes with .NET support built in
- **FREE** - FTN95 is free for personal and evaluation use. That includes the Visual Studio plug-ins and its unbeatable bug finding technology! What are you waiting for?

You can try Silverfrost Fortran for **free right now** by downloading the Personal edition.

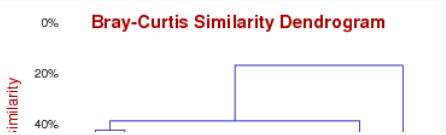
FTN95 + Simdem = Rapid Graphics Development

FTN95 includes ClearWin+ and that makes it easy to produce complex graphics -- Simdem makes it even easier! Simdem is a graphical library built on ClearWin+ that lets you produce complex graphs and plots in a few lines of Fortran. What is more, Simdem is **free**.

- **Easy** - Just link in the library and away you go
- **Free** - No licence required to use the library
- **Source Code** - You can build the library yourself if you want to.
- **Examples** - Simdem comes with a suite of examples.
- **Output** - Plots can be sent to a printer or converted to Postscript.
- **Mature** - Simfit is based on the same source code.

Below are just a few examples of output generated by SIMDEM using ClearWin+ and FTN95. There are more here.





Basket
Empty

Fortran Links

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Features
FAQ
CHECKMATE
Standard Applications
Microsoft .NET
Simdem
3rd Party Add-ons
Personal Edition
ClearWin+

Support
Forums

Documentation
Online Manual
Videos
Revision History

News

13th February 2020
Silverfrost Fortran FTN95 version 8.61 is released.

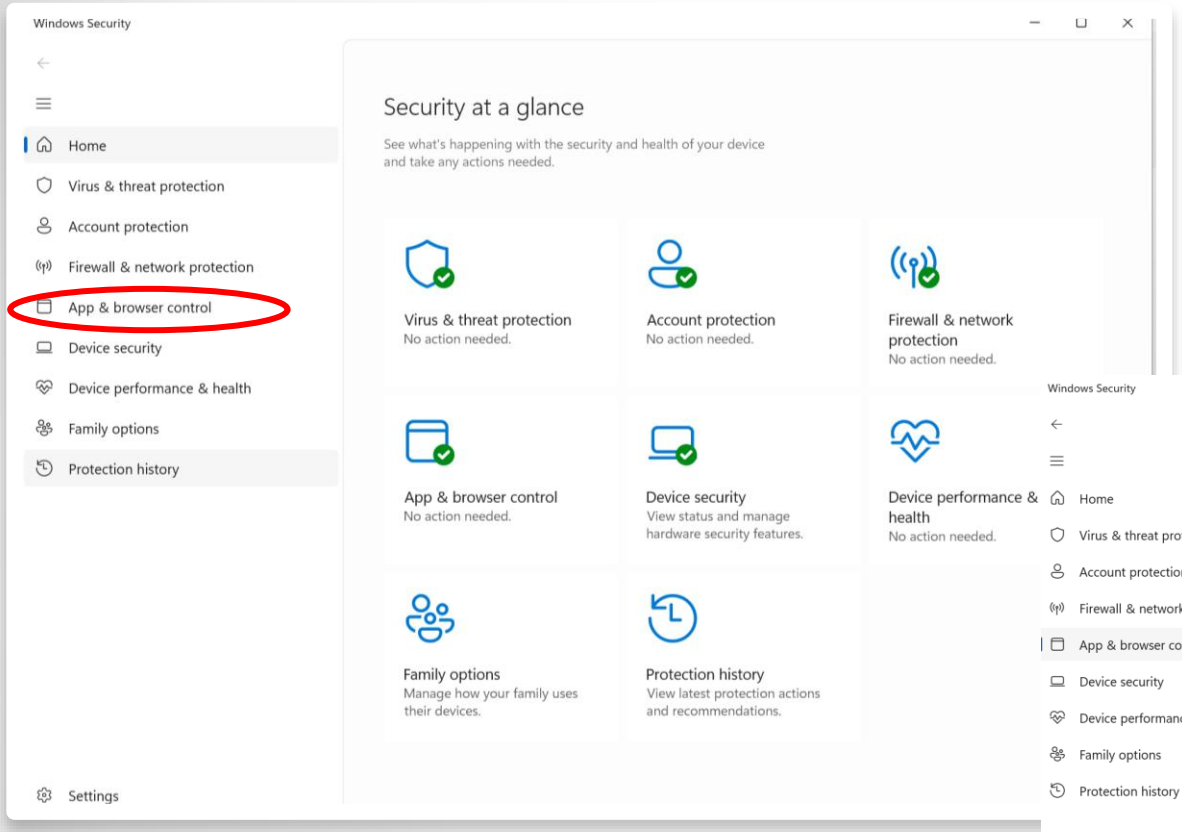
31st December 2019
Silverfrost Fortran FTN95 version 8.60 is released.

1st May 2019
Silverfrost Fortran FTN95 version 8.50 is released.

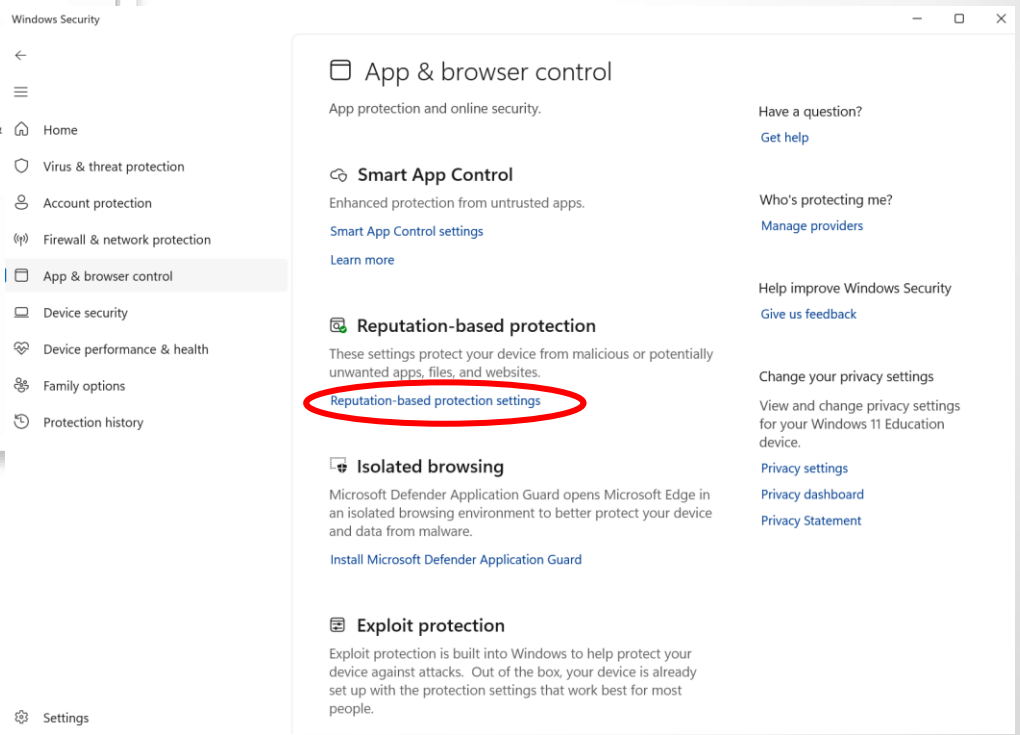




Αντιμετώπιση προβλήματος με δικά μας εκτελέσιμα αρχεία σε MS Windows10/11

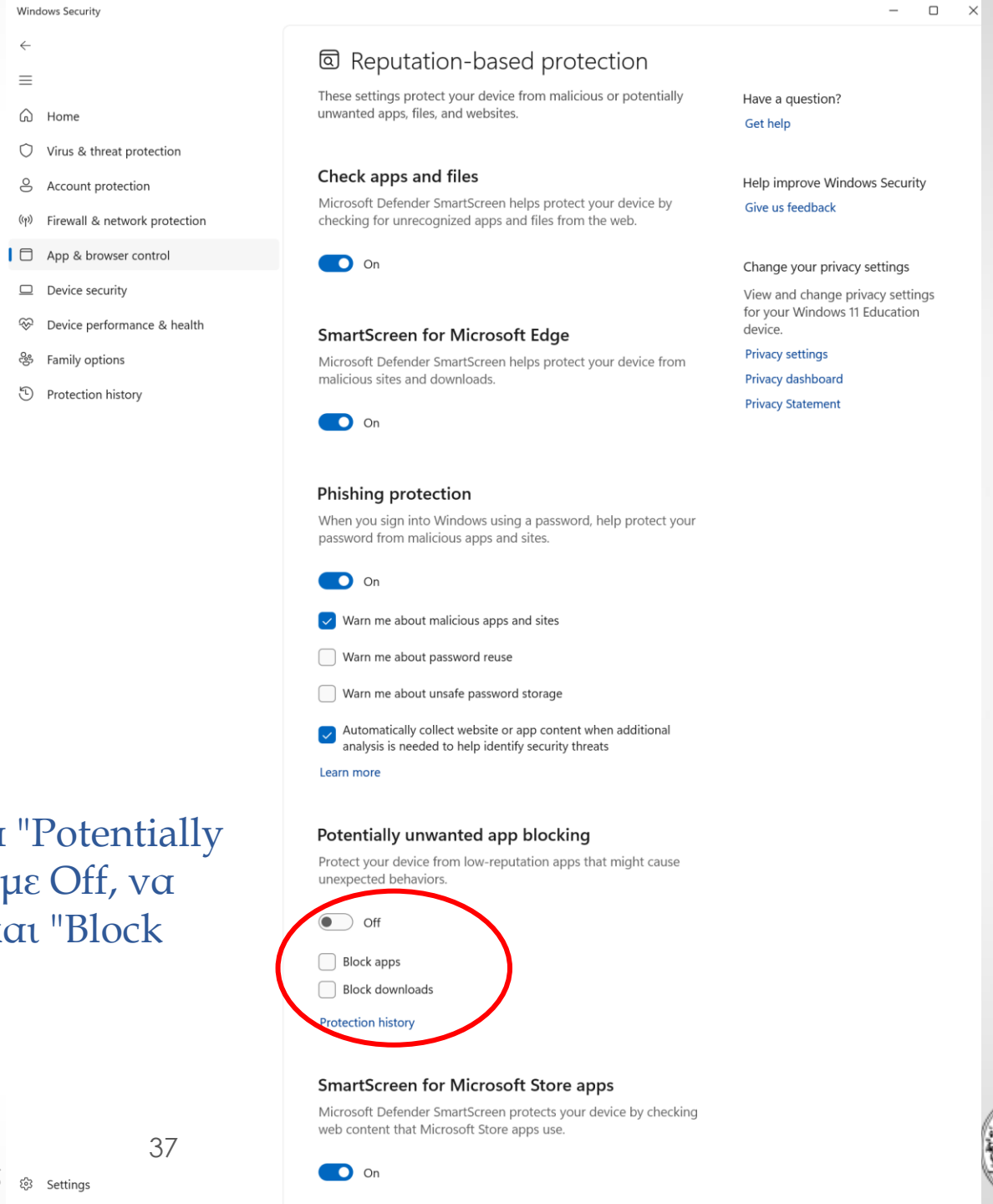


Ανοίγουμε το "Windows Security" popup window.
Επιλέγουμε "App & browser control" στα αριστερά.



Στο νέο περιεχόμενο στην ενότητα "Reputation-based protection" επιλέγουμε "Reputation-based protection settings" (κάτω από το Review με μικρά γράμματα).

Αντιμετώπιση προβλήματος με δικά μας εκτελέσιμα αρχεία σε MS Windows10/11



Στο νέο περιεχόμενο στην ενότητα "Potentially unwanted app blocking" επιλέγουμε Off, να είναι unchecked τα "Block apps" και "Block downloads"

Εξοικείωση με λογισμικό μαθήματος

ΑΣΚΗΣΗ:

1) Κατεβάστε από το Ίντερνετ και εγκαταστήστε στον υπολογιστή σας
   Το λογισμικό Dev-C++ ή FTN95
2) Δοκιμάστε να γράψετε, να κάνετε compile και κατόπιν run το πρόγραμμα “Hello World” (slide 19, lecture 3).





Ερωτήσεις & Απαντήσεις



