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1.) Complete the below table :

Item	Distributed OS		Network OS	Middleware OS
	Multiprocessor	Multicomputer		
① Degree of Transparency	Very High	High	Low	High
② Same OS on all nodes	yes	Yes	No	No
③ Number of copies of OS	1	N	N	N
④ Basic of Communication	Shared memory	messages	Files	Model Specific
⑤ Resource management	Global, Central	Global, Distributed	Per Node	Per Node
⑥ Scalability	No	Moderately	Yes	Varies
⑦ Openness	Closed	closed	Open	open

2.) What is the role of middleware in distributed system?

2.) Middleware OS takes the Scalability of Network Operating System (NOS) and Transparency of Distributed operation system.

The role of middleware is

① To make application development easy, by providing common programming abstractions.

② By masking the heterogenity and the distribution of the underlying hardware and operating system.

③ By Hiding Low Level programming details.

communication between

① Handling ^ Component

② Load Management ③ Directory authentication / authorization

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Goals of Middleware

① Provide Distribution Transparency

② Integrate existing components into Distributed system

③ Resolve Heterogenity

3.) Compare and Contrast Distributed and Network operating system.

(Parameter)	NETWORK OS	DISTRIBUTED OS
① Defination	① Loosely-coupled OS for heterogenous multi-computers (LAN & WAN)	① Tightly coupled OS for multi processors and homogenous multi computers.
② Objective	② To provide local services to remote clients	② Manages the hardware resources.
③ Communication (Basis)	③ File Based, shared folder Based.	③ Message Based or Shared-memory Based
④ Scalability	④ Network os are highly scalable. (new machine can be added easily)	④ Distributed OS is less scalable. The process to add new hardware is complex.
⑤ Fault tolerance	⑤ Less fault tolerant (as compared to DOS)	⑤ Very High fault tolerance
⑥ Autonomy	⑥ Each machine can act on its own, thus High Autonomy.	⑥ It has Poor rate of Autonomy
⑦ Ease of Implementation	⑦ Easy to Build and Maintain	⑦ Implementation is Difficult
⑧ Architecture	⑧ n Tier client server Architecture	⑧ 2 Tier Client Server Architecture
⑨ operating System	⑨ Network os have their own copy of OS.	⑨ Distributed OS-based nodes have the same copy of OS.
⑩ Resource management	⑩ Resources are maneged at every node	⑩ Global Central distributed management is used to manage resources.