

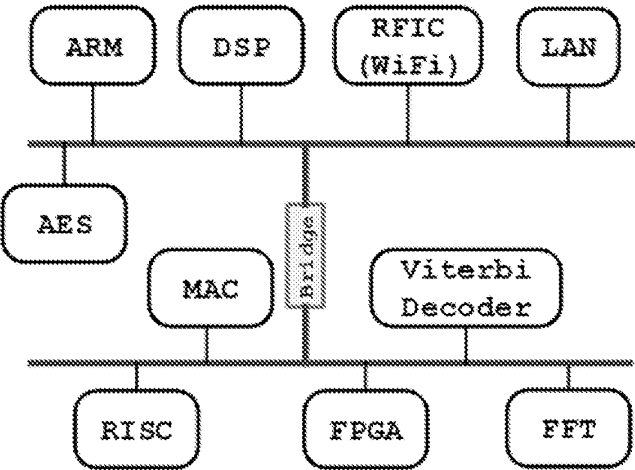


FIG. 1A

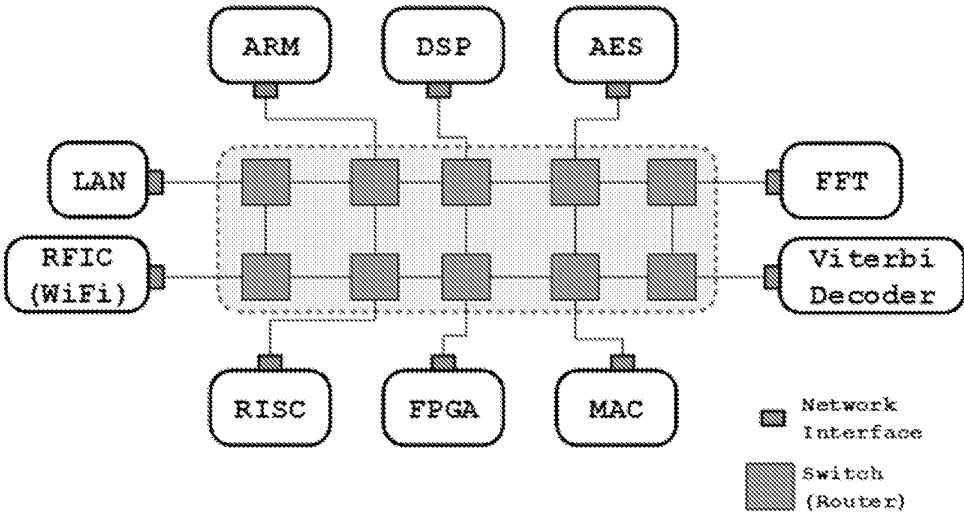


FIG. 1B

2/10

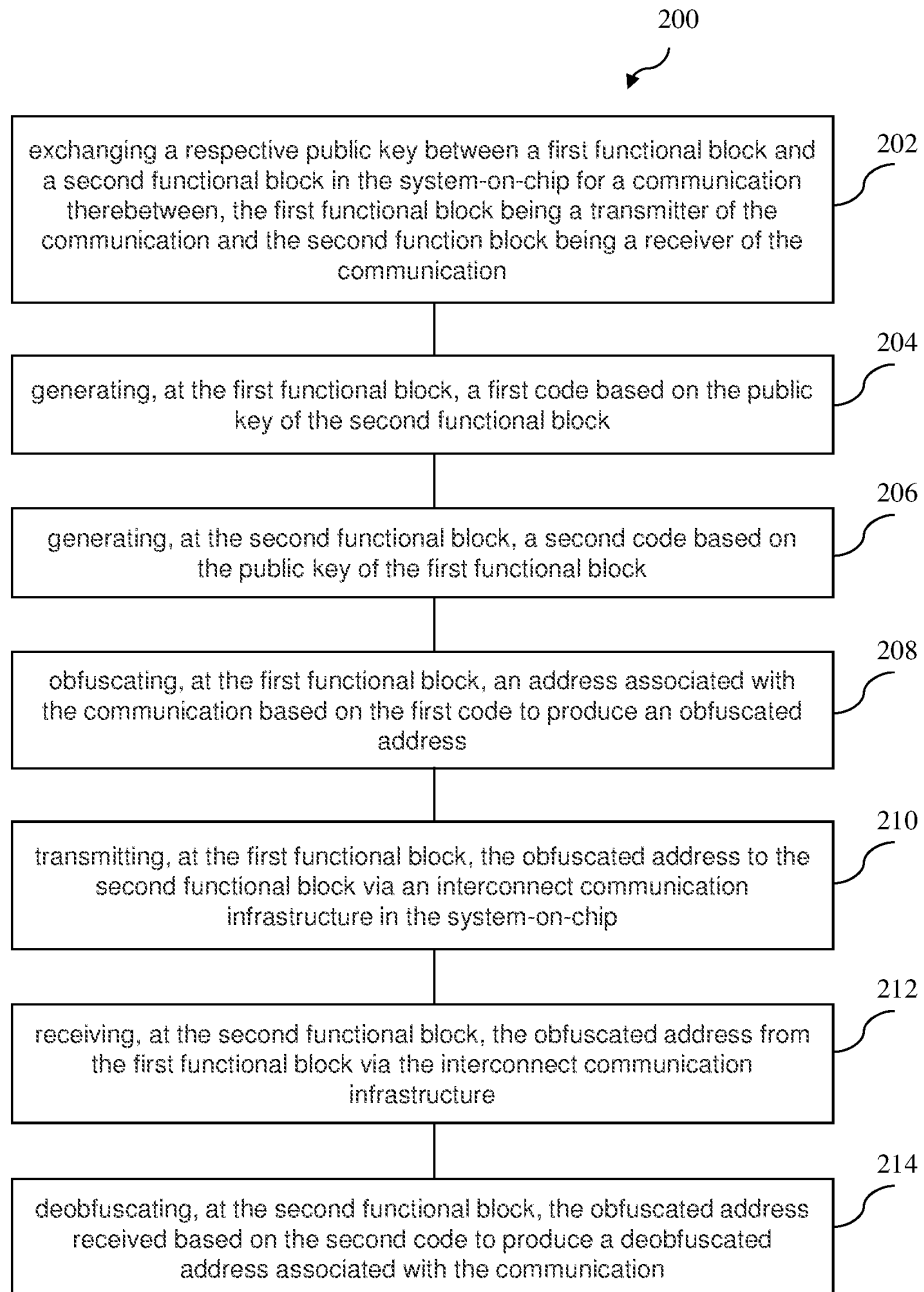


FIG. 2

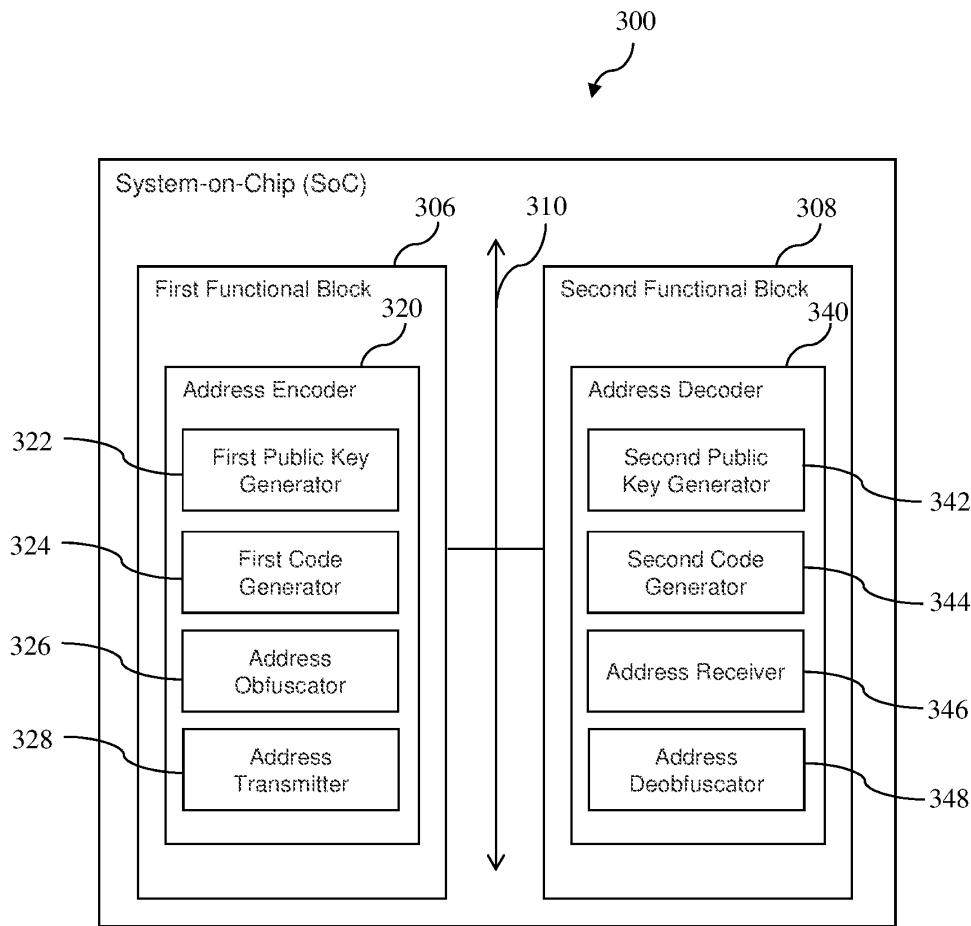
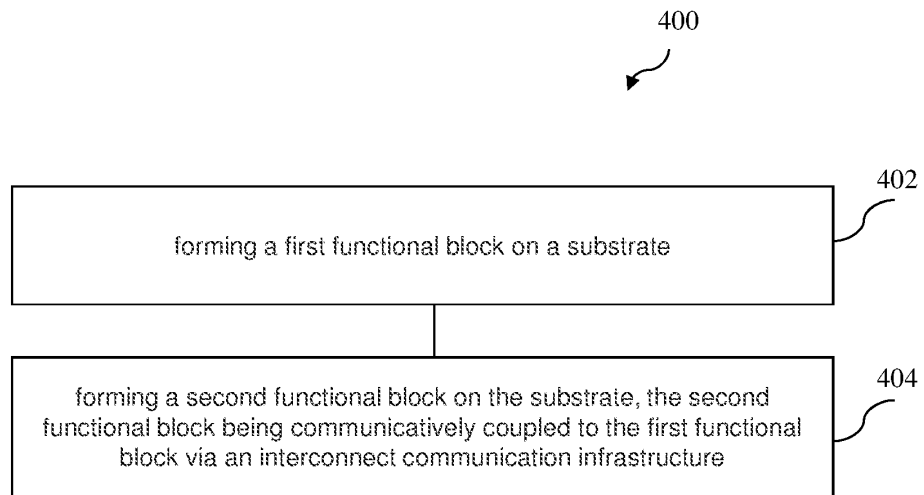


FIG. 3

4/10

**FIG. 4**

Aspect	Software Data Obfuscation	Hardware Access Pattern Obfuscation	Lightweight Communication Obfuscation
ORAM factor	ORAM-inspired solution	Address obfuscation with/without ORAM semantics	No ORAM
Computation speed	Very slow (~50x reduction)	Relatively fast with minimal access latency	Very fast (no to low-bandwidth reduction)
Software/Hardware changes	Software-based No hardware change	Changes in both software and hardware	Hardware-based No software change
Metadata storage	Excessive and resides in CPU	Partition storage in both CPU and memory	No metadata required
Protocol changes	Changes required for different communication protocol	Customized to specific memory access protocol	Applicable to heterogeneous communication traffic on hardware
Overhead	Excessive communication overhead	Substantial communication overhead	No communication overhead
Security	Fixed security parameter	Fixed security parameter	Flexibility in security mode selection
Application	Memory related communication	Memory related communication	Generic communication

FIG. 5

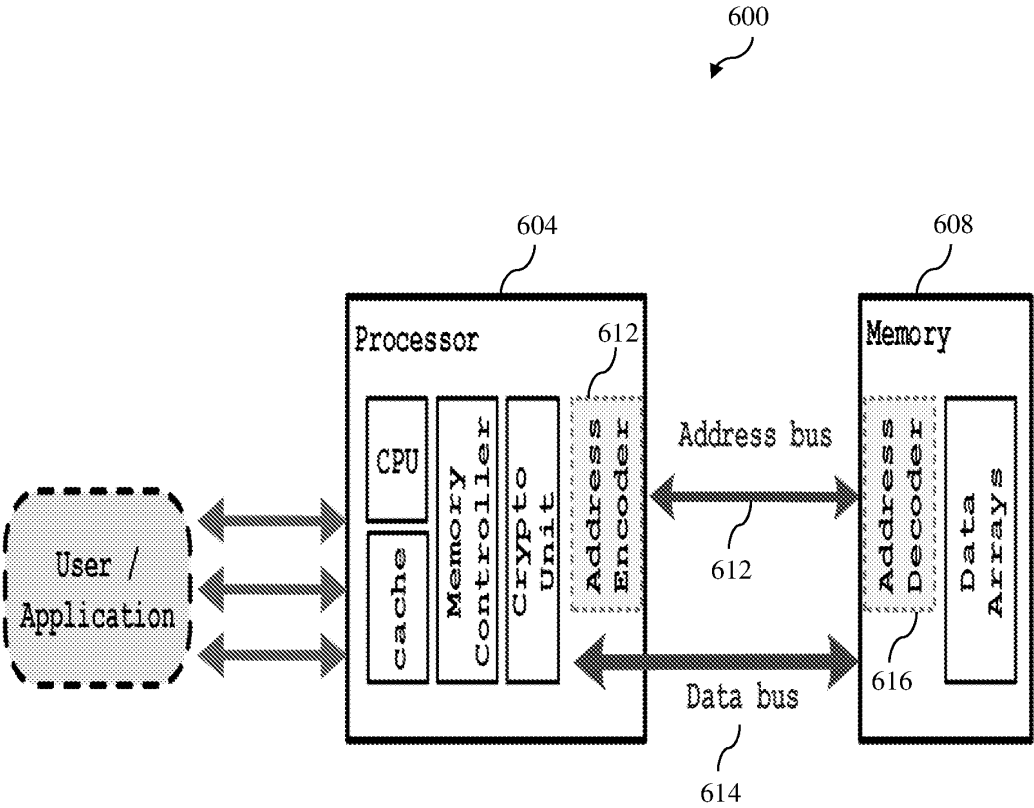
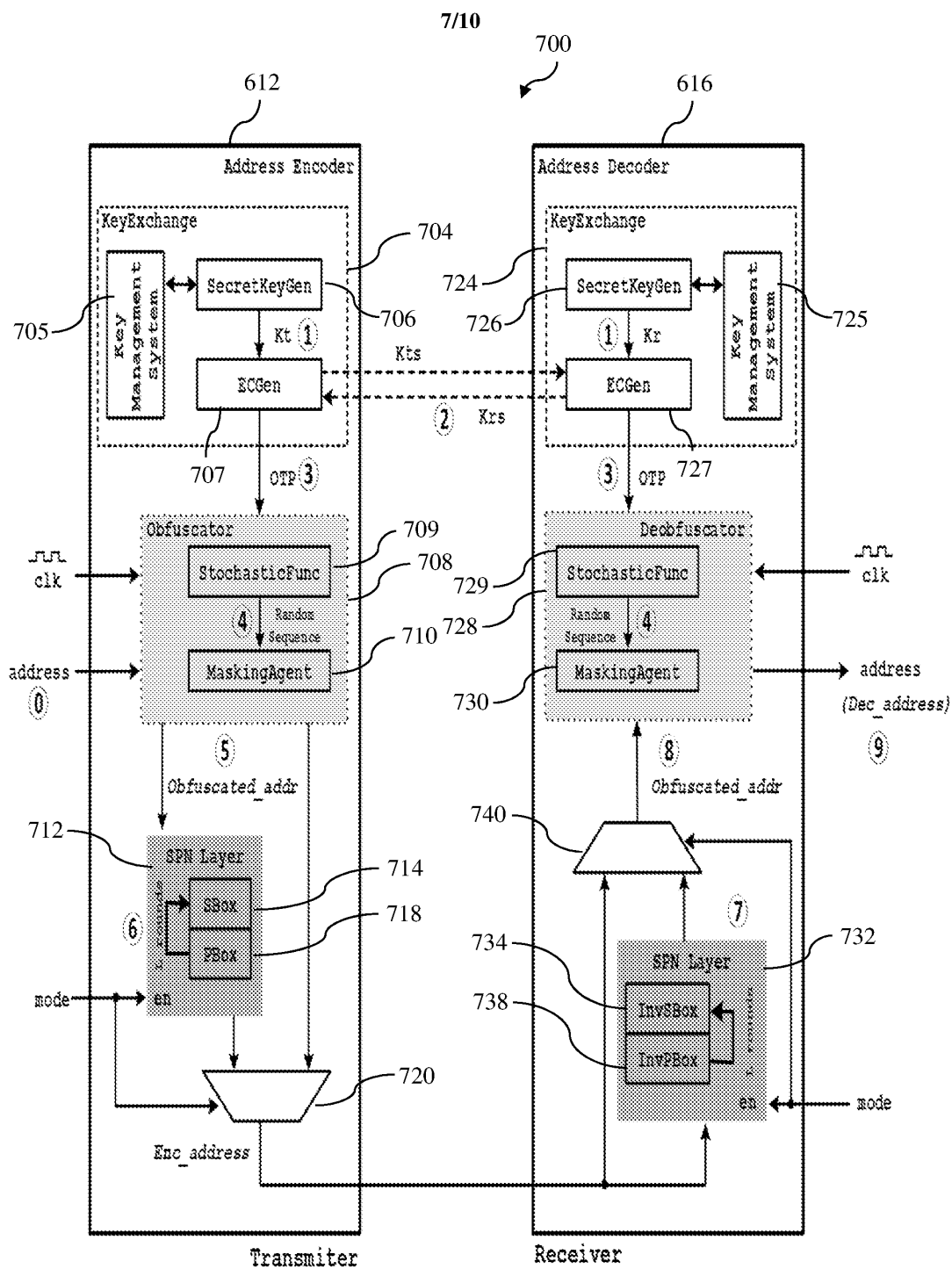


FIG. 6



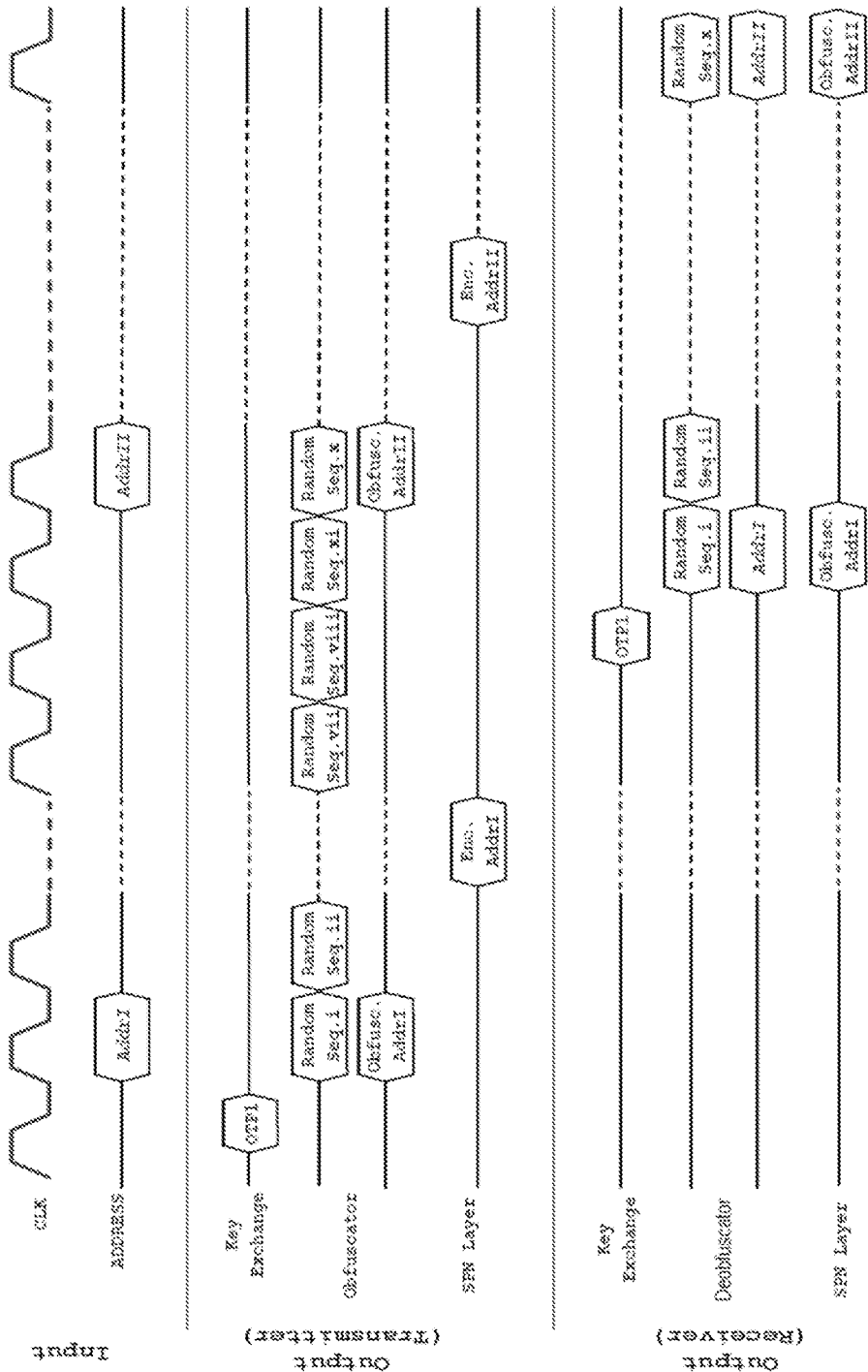


FIG. 8

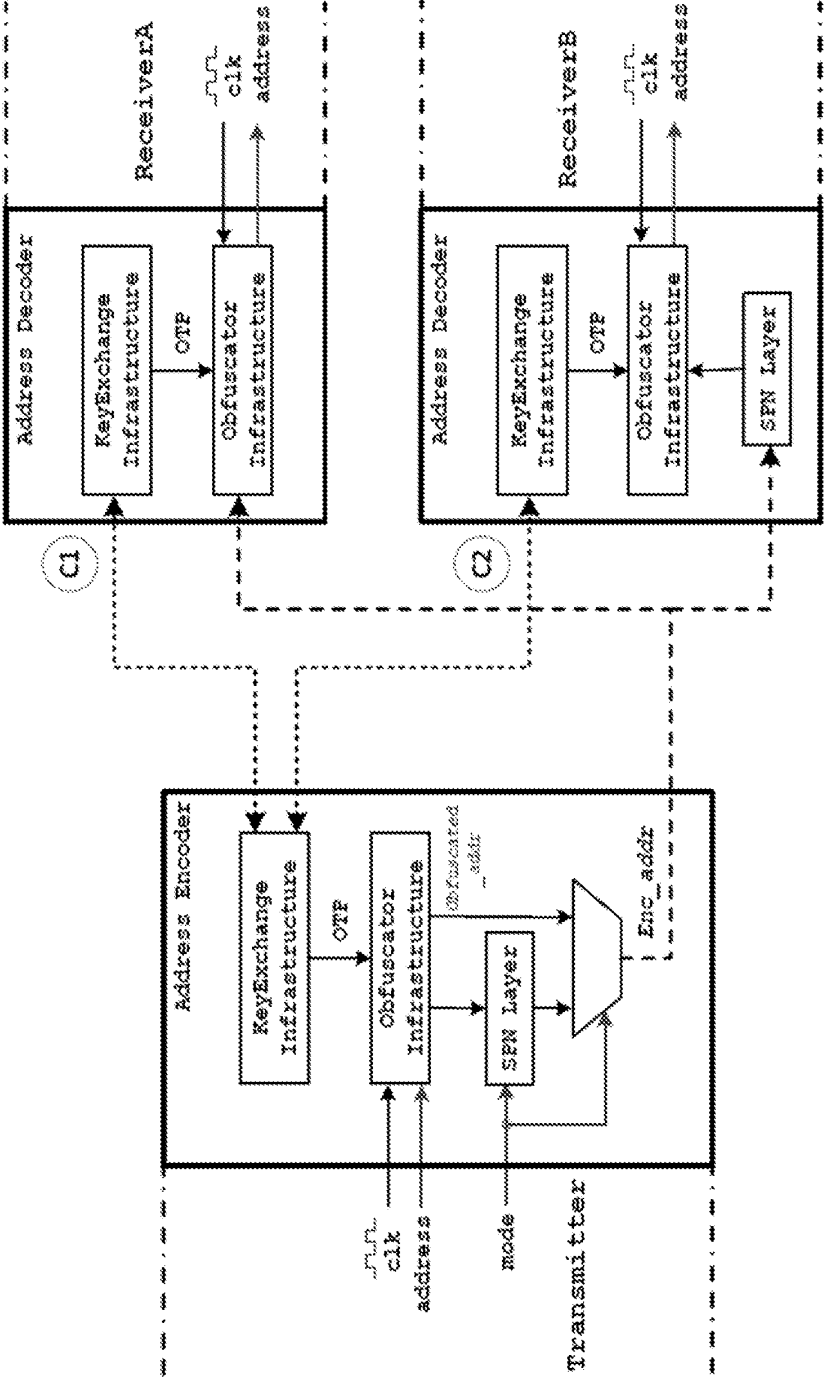


FIG. 9

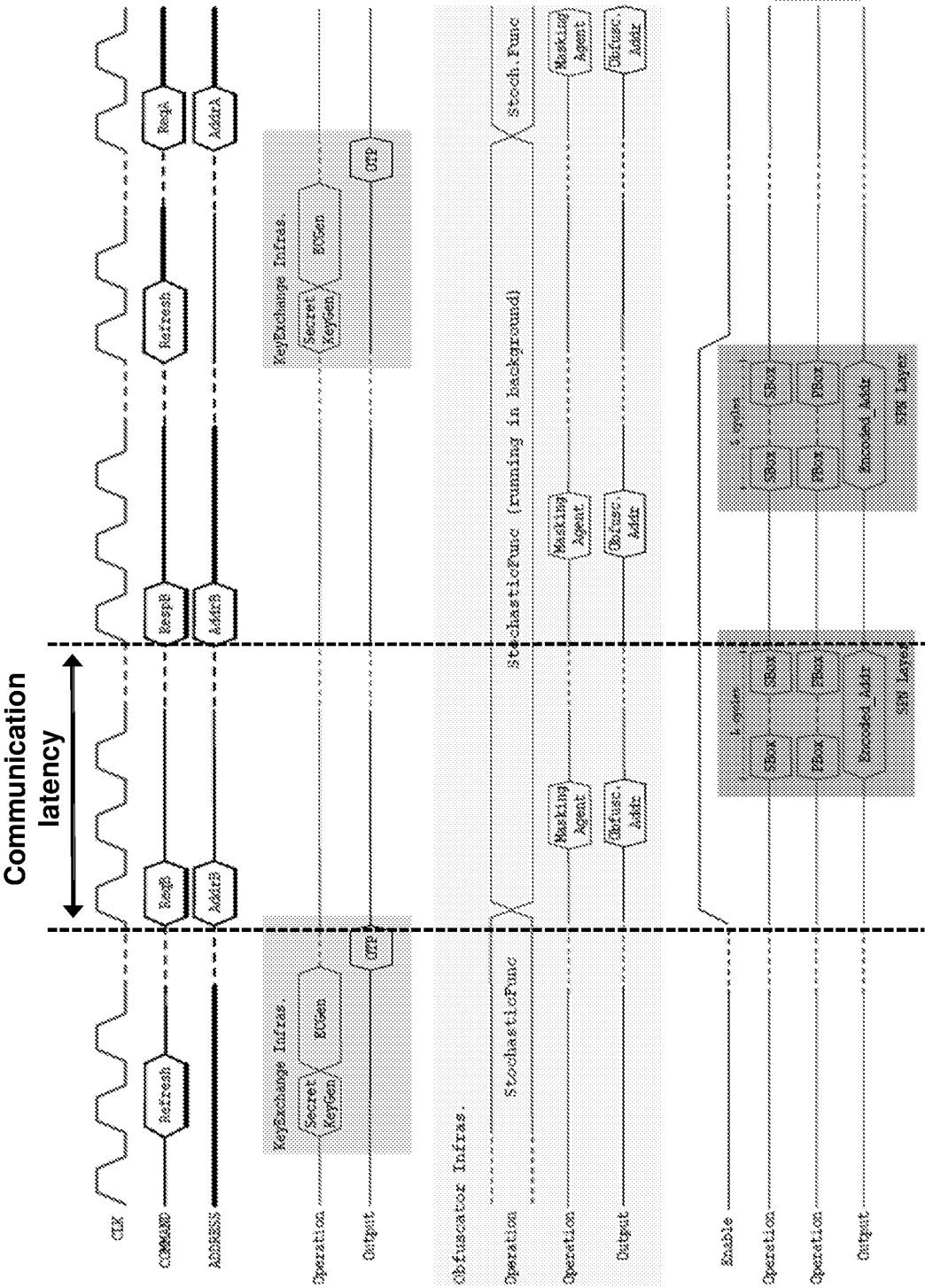


FIG. 10