

Multi-Party Computation for Privacy Preserving in the Metaverse Environment

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Contents

- ❖ What is Metaverse?
- ❖ Metaverse Use Cases
- ❖ Metaverse Privacy Issues
- ❖ Multi-Party Computation
- ❖ MPC Scenarios for the Metaverse Environment

What is Metaverse?

❖ Origin of Metaverse

- ✓ Neal Stephenson's novel 'Snow Crash' in 1992.
- ✓ A compound word combining 'Meta' meaning virtual or transcendent, and 'Universe' referring to the world or cosmos.
- ✓ The metaverse environment signifies the convergence of the virtual world and the real world.

❖ Core elements of the Acceleration Studies Foundation

- ✓ Virtual World, Mirror World, Augmented Reality, and Lifelogging.
- ✓ Not only VR and AR but also everything from social networking services(SNS) to online games.

❖ My definition

- ✓ Users can engage social, economic, and cultural activities and create value through their avatars, which represent their virtual counterparts, in the metaverse environment.

Metaverse Use Cases

Platform	Use case
Gather	'Metaverse Children's Burn Hospital' of the Hallym University Medical Center
Fortnite	Release of BTS's new dance moves
ZEPETO	BLACKPINK's virtual fan signing event and music video production
Animal Crossing: New Horizons	Joe Biden's election camp
Minecraft	Children's Day event held at the Blue House
Jump VR	2021 Soonchunhyang University entrance ceremony

Metaverse Privacy Issues

Platform	Privacy issues
ZEPETO	Exposure of users' facial images, Personal information leakage through surveys
Nike Run Club, Pokémon GO	Exposure of daily routines and locations through GPS in apps
Animal Crossing: New Horizons	Account information breaches
Roblox	Instances of administrator account hacking

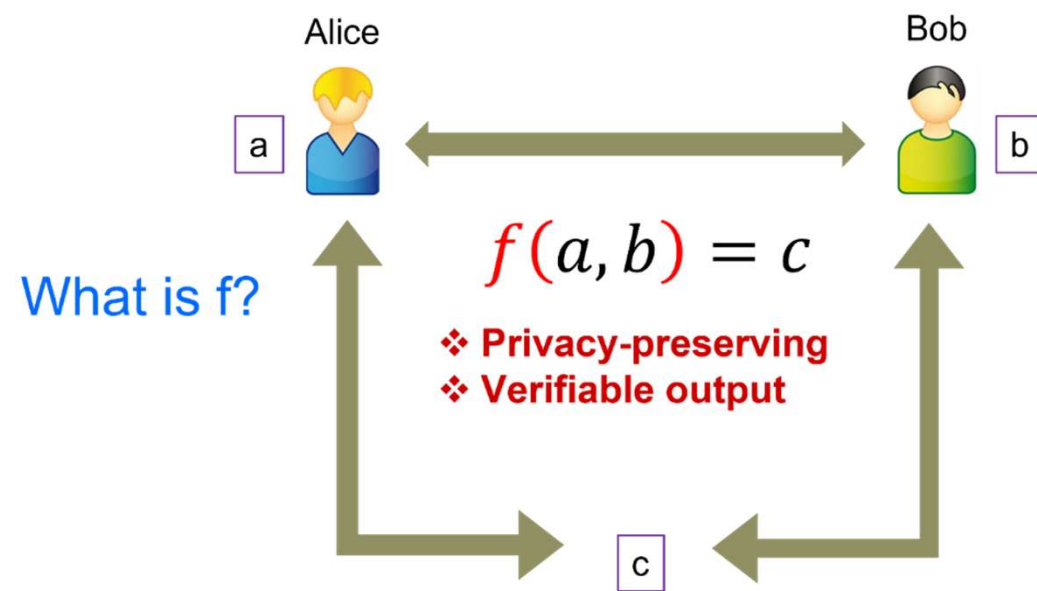
❖ Private Set Intersection

- ✓ Patients' medical data, biometric authentication information, bidding information, political preferences, etc. can be exposed.
- ✓ The KISA has warned against excessive collection and usage of personal information, including biometric data, gestures, gaze, and other non-traditional data types, which could threaten user privacy preservation.

Multi-Party Computation

❖ Secure Multi-Party Computation (MPC)

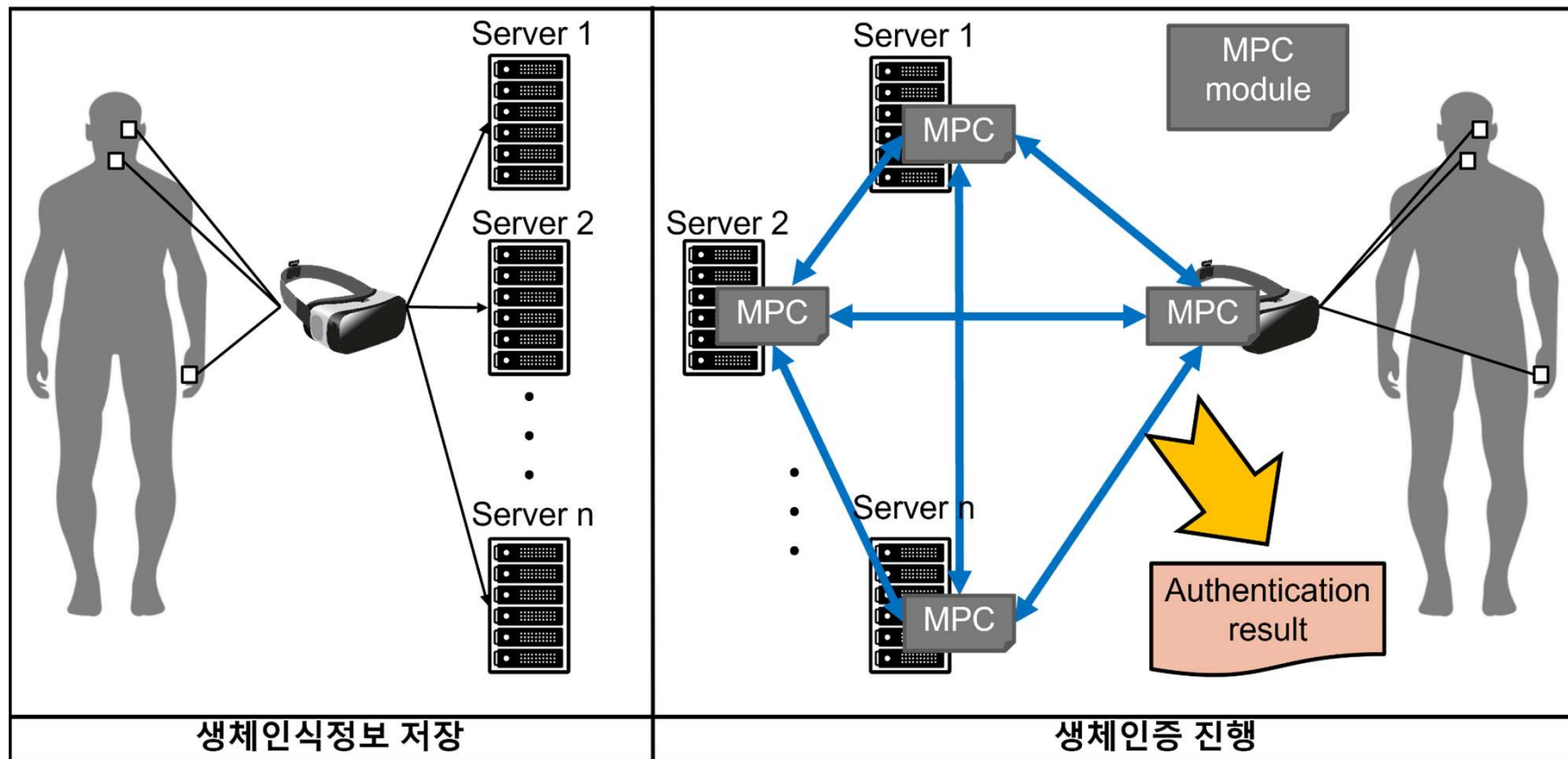
- ✓ Enable a set of parties to interact and compute a joint function of their private inputs while revealing nothing but the output.



Trusted Computing between Trustless Parties

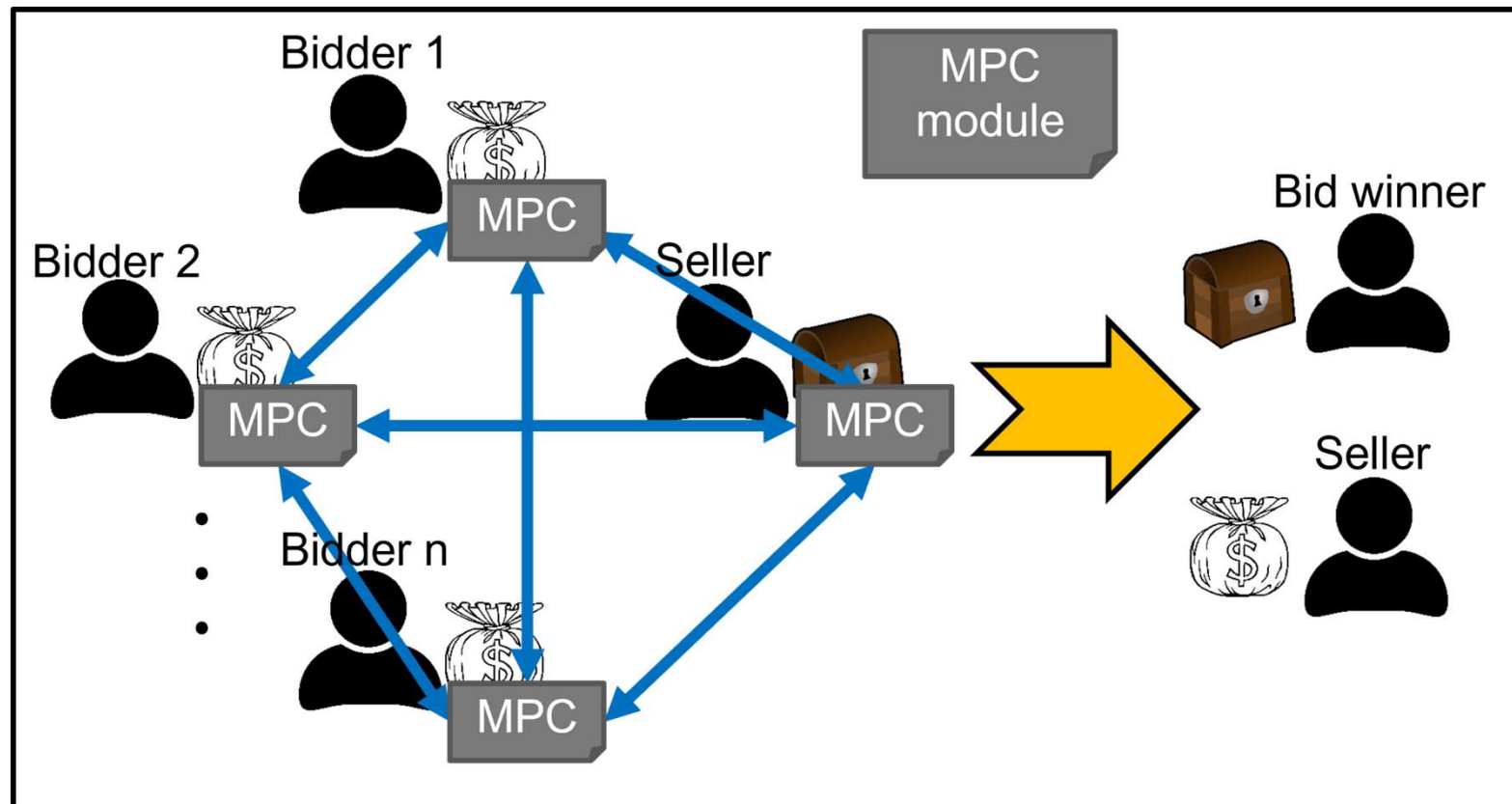
MPC Scenarios for the Metaverse Environment

❖ User Biometric Data Protection



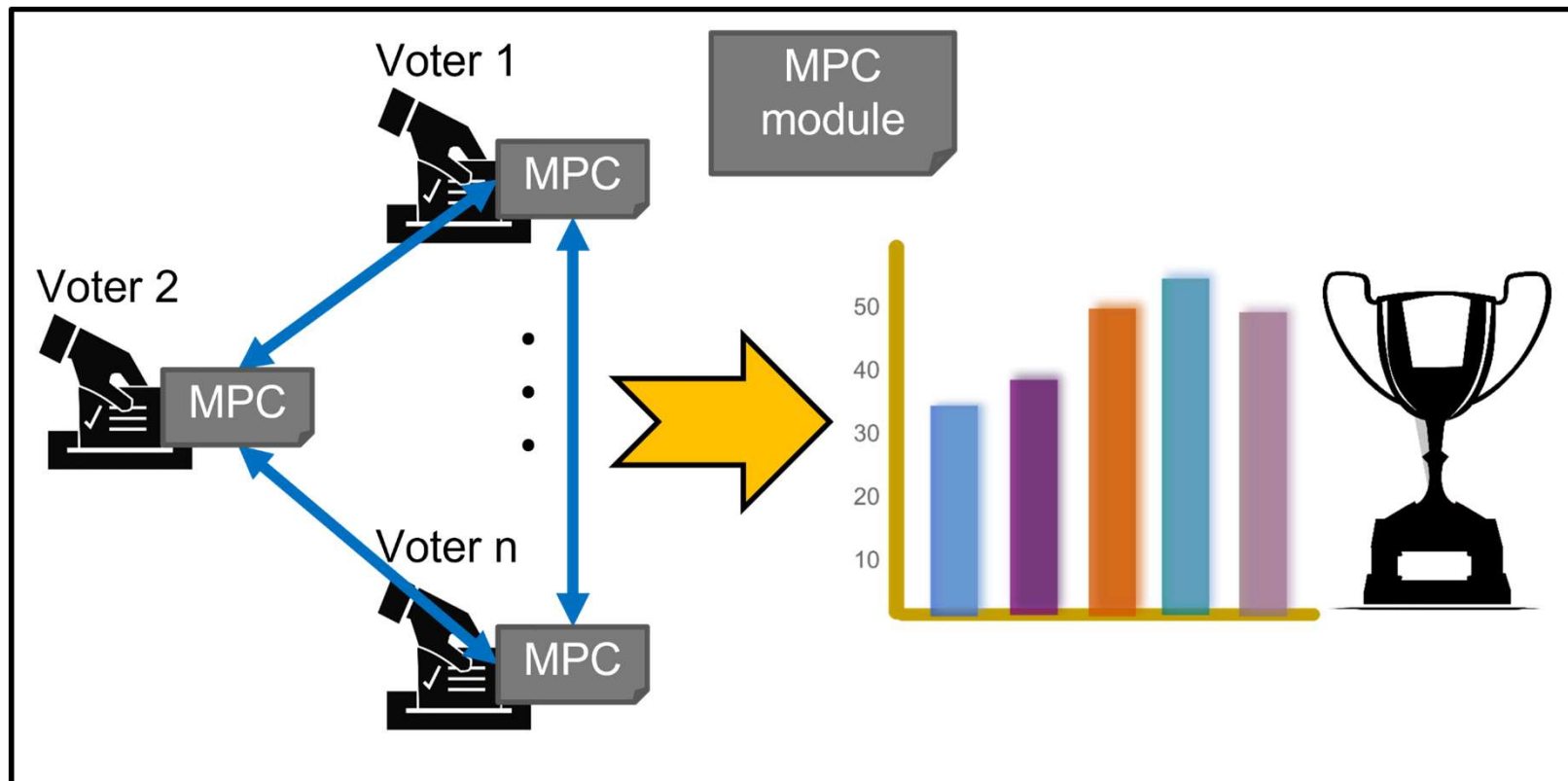
MPC Scenarios for the Metaverse Environment

❖ Bidder Privacy Preservation Auction



MPC Scenarios for the Metaverse Environment

❖ Trustless Voting



Thank you