

Cloud Computing in Tactical Environments

General Scenario

A warfighter in a tactical situation captures biometric or chembio data using a sensor connected to a mobile handheld device. The warfighter needs results quickly to make important decisions.

General Scenario—Challenges

Device limitations

- Performing biometric or chembio analyses can be too expensive on the handheld device (in terms of CPU and memory usage).

Energy limitations

- Even with enough memory and CPU power, the battery on the handheld may not be enough to finish the processing.

Network limitations

- Analysis on the handheld requires data that may not be available on the handheld due to
 - bandwidth limitations
 - data and communication channel security concerns

Device reliability

- The device may fail (software/hardware) during processing.

Objective

Investigate and apply principles of cloud computing to support compute- and energy-intensive tasks on resource-constrained handheld devices in tactical environments.

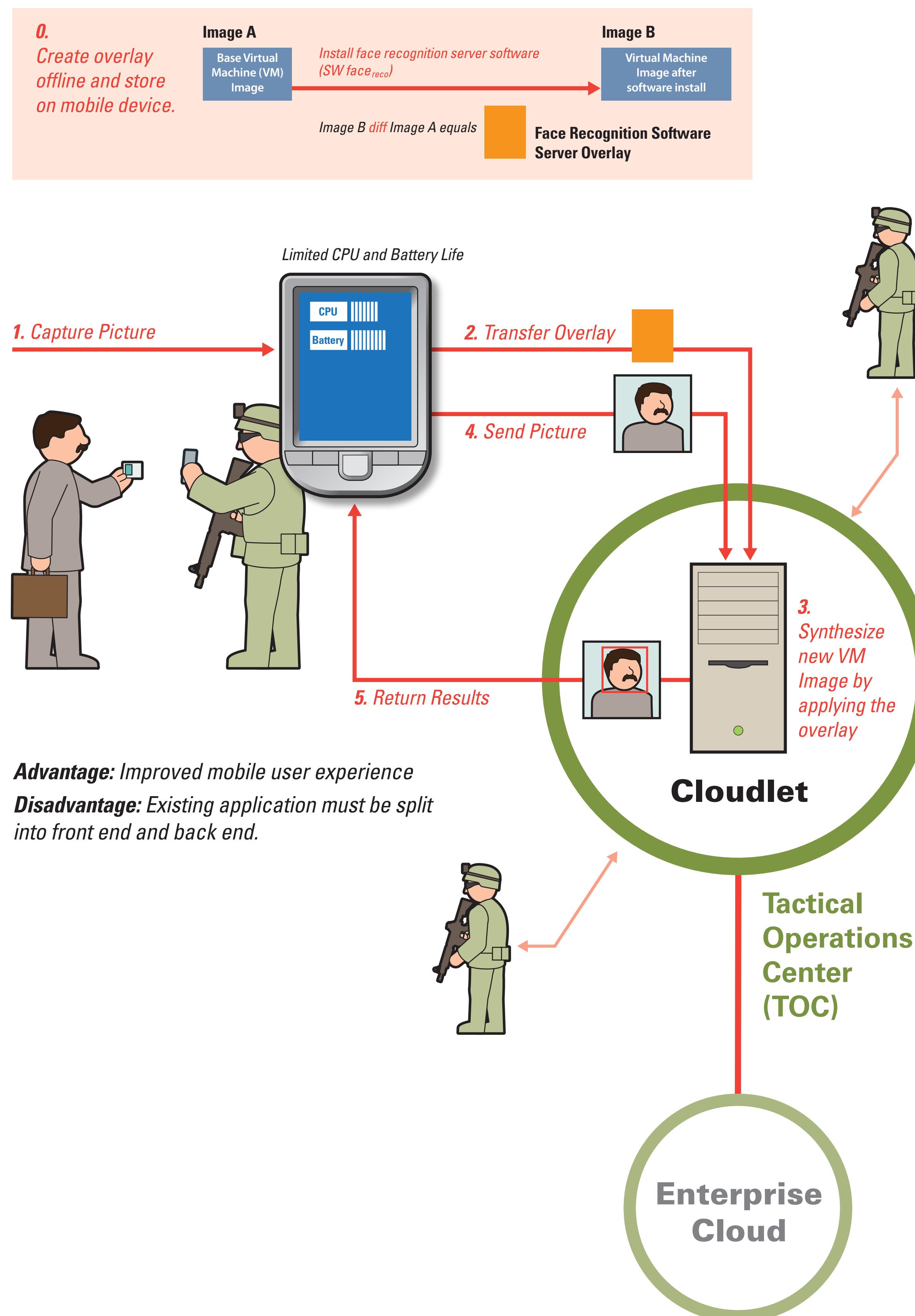
Examples of compute-intensive tasks

- biometric analysis and matching
- face recognition
- chembio analysis
- speech recognition and translation
- natural language processing
- image and video processing

Hypothesis

For the face recognition application, the battery consumption for transmission is much lower than battery consumption for computation.

- Measures
 - Energy per CPU cycle
 - Energy per MB transmission
- Goal: 10x

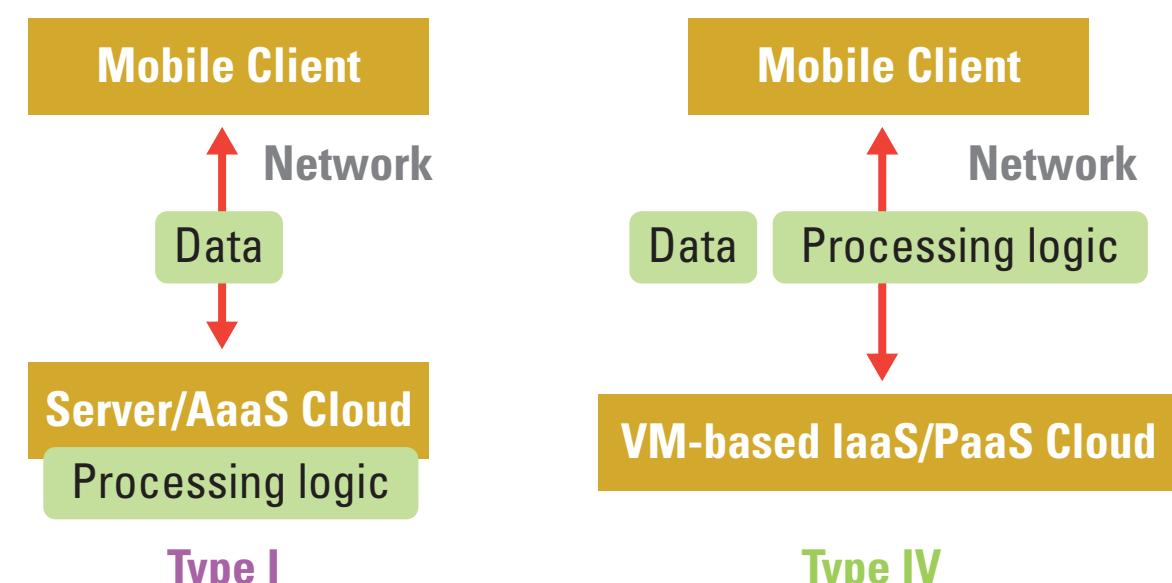
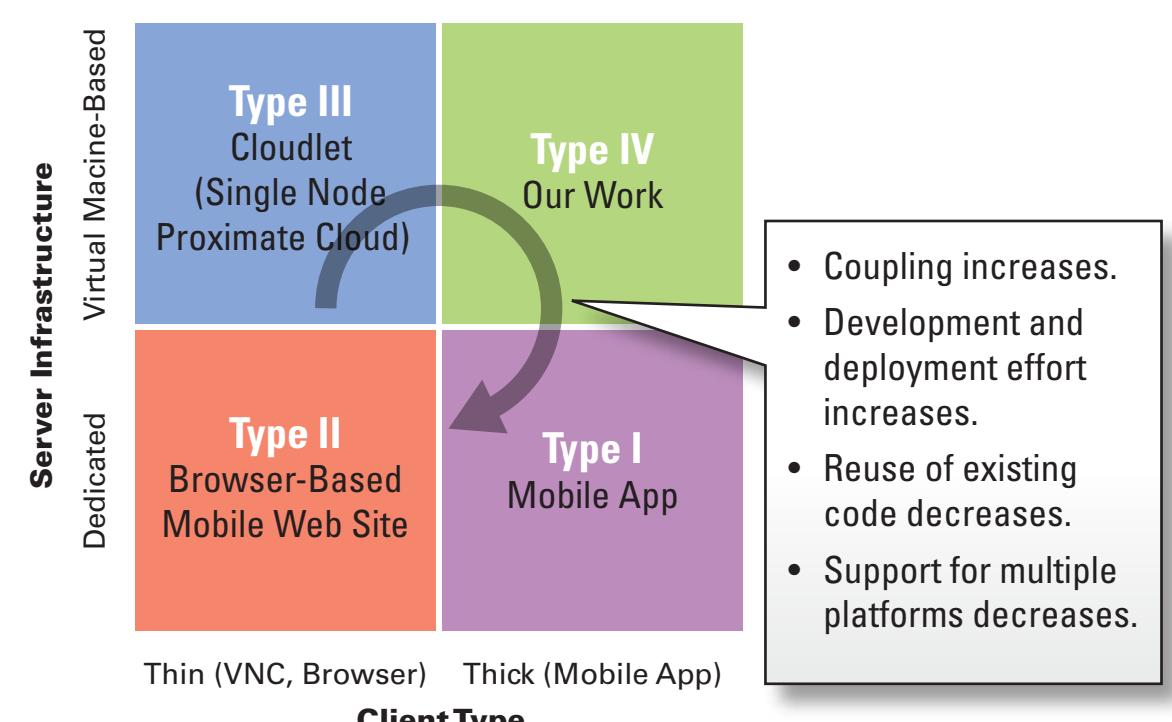


How Can Cloud Computing Help?

Offloading expensive computation to the cloud for remote execution can address the following challenges:

- Mobile elements are resource-poor relative to static elements.
- Mobile elements rely on a finite energy source.

Mobile Client-Server Architecture Options



Highlights of Our Approach

- **Physical Proximity** of mobile devices with the cloudlet (computing node) reduces network latency as compared to using a generic enterprise cloud.
- **Dynamic Virtual Machine Synthesis** enables support for different platforms at runtime.
- **Thick Mobile Client** provides better user experience and reduces the complexity of integrating peripherals (camera, fingerprint and biometric scanner) as compared to using a remote desktop solution (VNC, RDP).

Advantages of Our Approach

- Even with a thick client there should still be lower battery consumption due to fewer CPU cycles.
- As long as a mobile app can be quickly developed, most of the server code should be reusable.
- Approach is suitable for warfighter needs as it fits the TOC-warfighter use case.

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