Guaranteed Architecture for Physical Security (GAPS)

Prakash Sarathy
Northrop Grumman
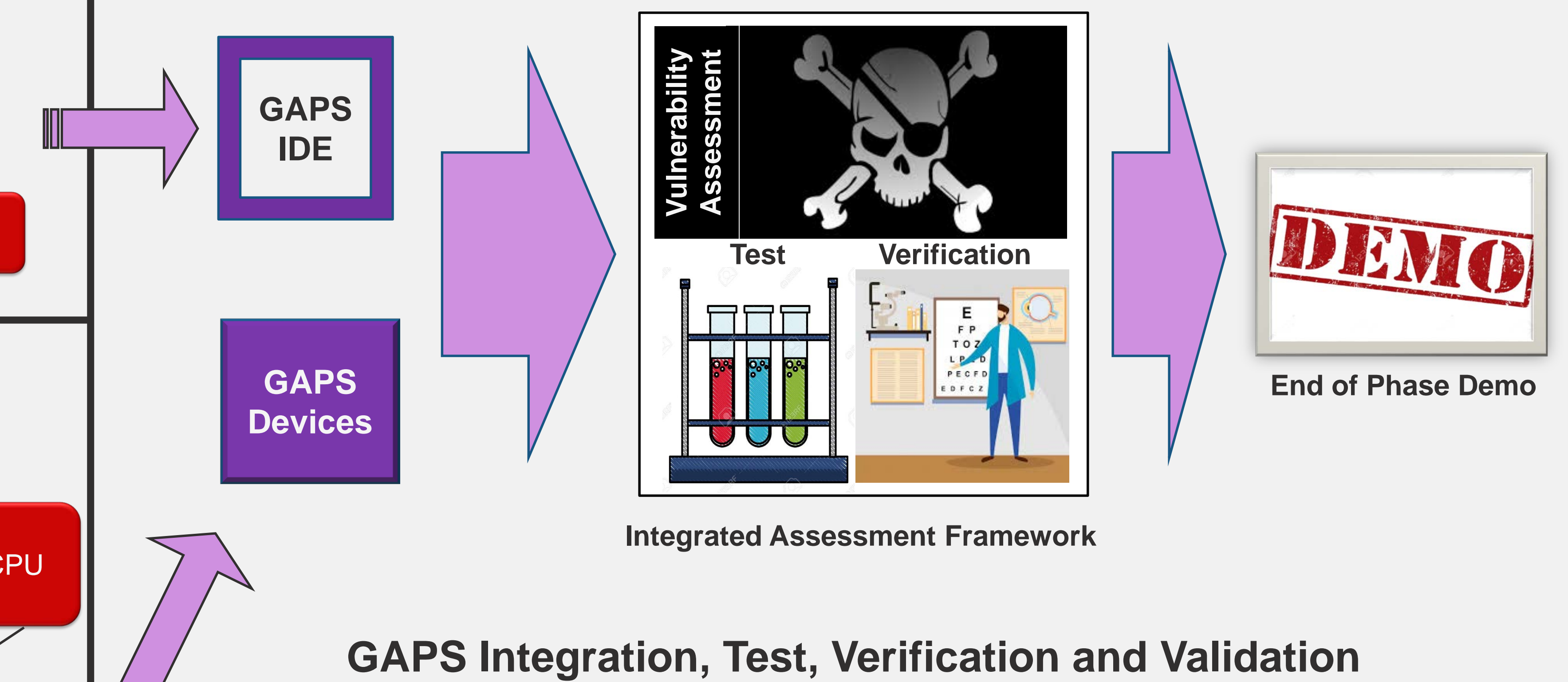
Design & Security

GAPS Enables Automated Binary Generation
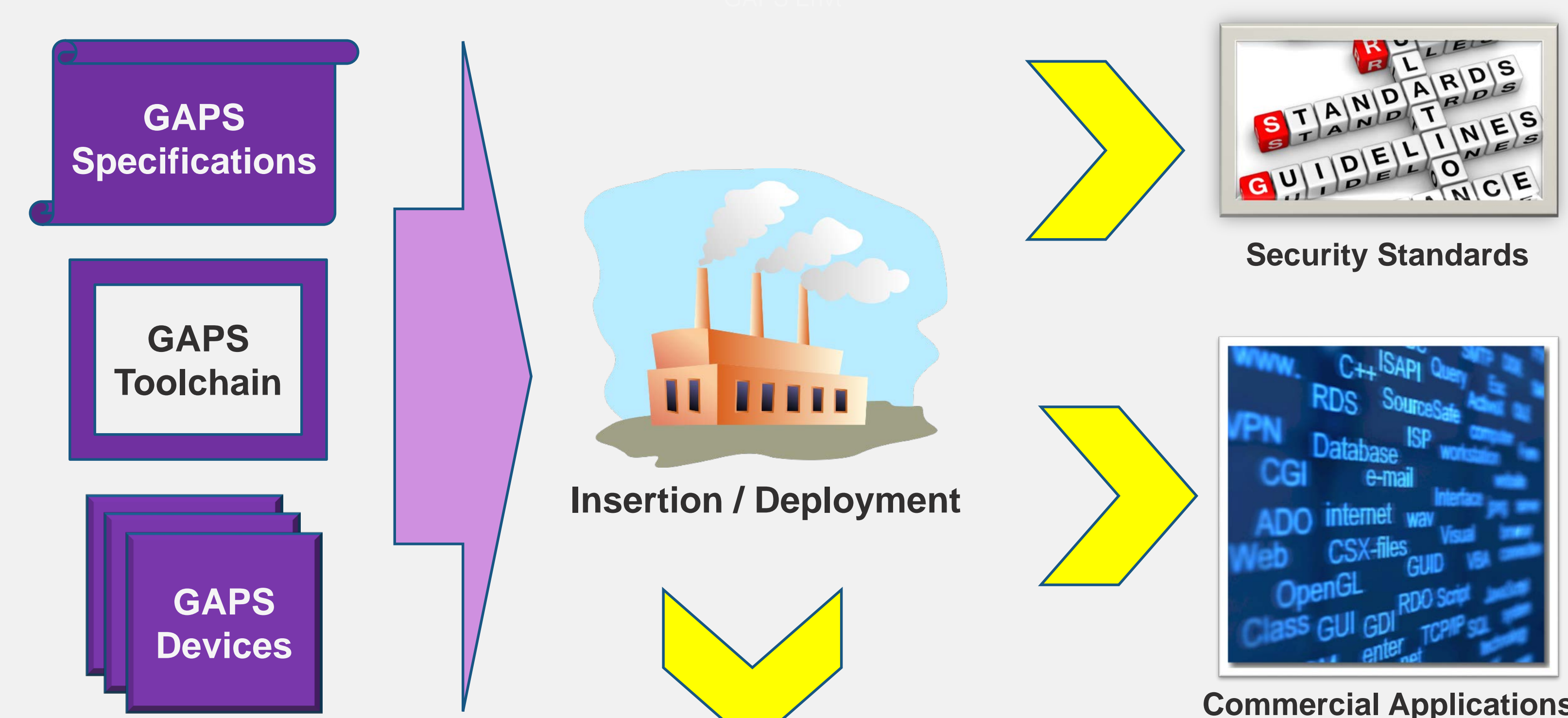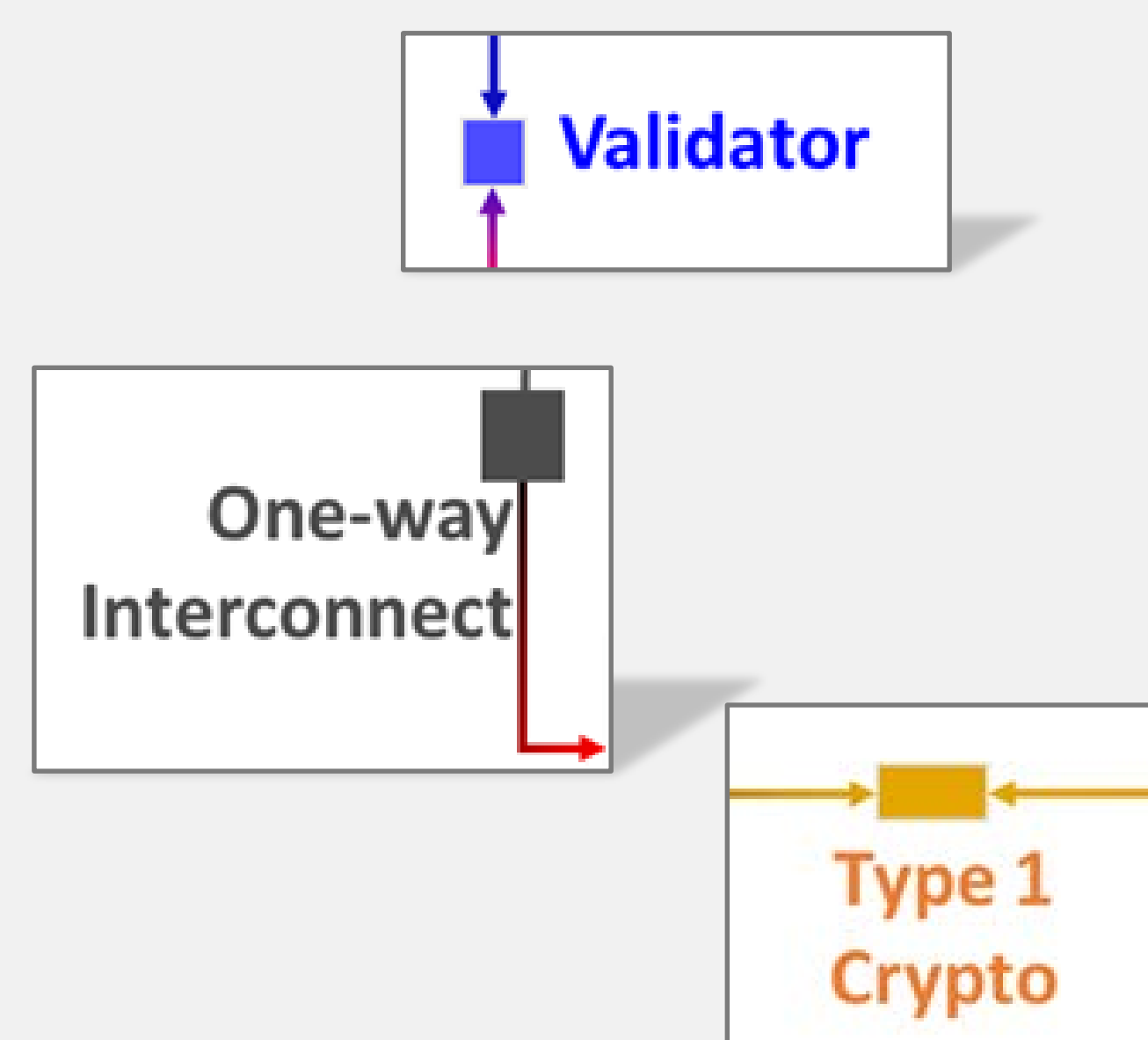
w/o GAPS

C

```
//Notional sensitive data
#include <stdio.h>
int main() {
    int myInt, mySensitiveInt, result;
    mySensitiveInt = 42;
    scanf("%d", &myInt);
    result = myInt + mySensitiveInt;
    printf("%d", result);
    return 0;
}
```

ASM

```
main:
    ...
    movl 0x2a, eax
    call scanf
    mov -0x04(ebp), edx
    add edx, eax
    mov eax, -x10(ebp)
    call printf
    ...
```

Board Level

CPU — Sensor — Display

w/ GAPS

C

```
//Notional multi-level data
#include <stdio.h>
#include <gaps.h>
int main() {
    int myInt, result;
    #classify
    int mySensitiveInt = 42;
    #nclassify
    scanf("%d", &myInt);
    result = myInt + mySensitiveInt;
    printf("%d\n", result);
    return 0;
}
```

ASM

```
main:
    call scanf
    mov -0x04(ebp), eax
    call gapsGlueTransmit
    ret
```

```
main:
    movl 0x2a, ebx
    call gapsGlueReceive
    add eax, ebx
    mov ebx, -0x10(ebp)
    call printf
    ...
```

Sensor — CPU — One-Way Interconnect — CPU — Sensor

Principal Integrator for the GAPS Program: Northrop Grumman Corp.

GAPS IDE

GAPS Devices

Vulnerability Assessment — Test — Verification

Integrated Assessment Framework

DEMO

End of Phase Demo

GAPS Integration, Test, Verification and Validation

GAPS Specifications

GAPS Toolchain

GAPS Devices

Insertion / Deployment

Security Standards

Commercial Applications

GAPS Insertion Into Industry Applications and Programs

Multilevel Security Provided by Provable Hardware, Not Buggy Middleware Code

- R&D on appropriate verifiable bus standards

- Develop board support packages (BSPs) around required components to enable missions

- R&D on topologies that require no feedback and still maintain high reliable throughput

- R&D on switch fabric controllers that maintain state and perform in-line verification of bidirectional connection data

Validator

One-way Interconnect

Type 1 Crypto

THE ELECTRONICS RESURGENCE INITIATIVE