G2S: Why a Standard Protocol Really is Better

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Agenda for this session:

- What is G2S? (a little history)

- The Benefits of G2S

- Securing the New Environment

- Case Study – The Road to Aria

A Quick History of G2S

》》 How did we get here?

First we had SAS

- SAS became the de-facto standard over the last 25 years

- Requires a SMIB in the EGM
  - Player peripherals connect to the SMIB
  - SMIB connects to system via proprietary protocol

- Polled Serial protocol – 19,200 bps
  - No way to push content to the EGM

- Server-based gaming is not possible with SAS

What is GSA / G2S?

- GSA = Gaming Standards Association
  - EGM and System Manufacturers
  - Operators
  - Test Labs and Regulators

- Goal – create three standard protocols
  - GDS ⇔ G2S ⇔ S2S

- G2S = Game to System Protocol
  - Developed by GSA members (all could contribute)
  - Extensible so manufacturers can add "Secret Sauce"

WHY is G2S Cool?

1. Every EGM can talk directly to <u>multiple</u> hosts

2. Uses off-the-shelf Internet technologies

3. Host can access incredible data in each EGM

4. Since G2S accommodates multiple hosts
   ▸ The slot system does the regulated apps, allowing new applications to flourish
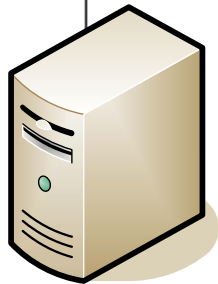
Here's HOW your floor works now
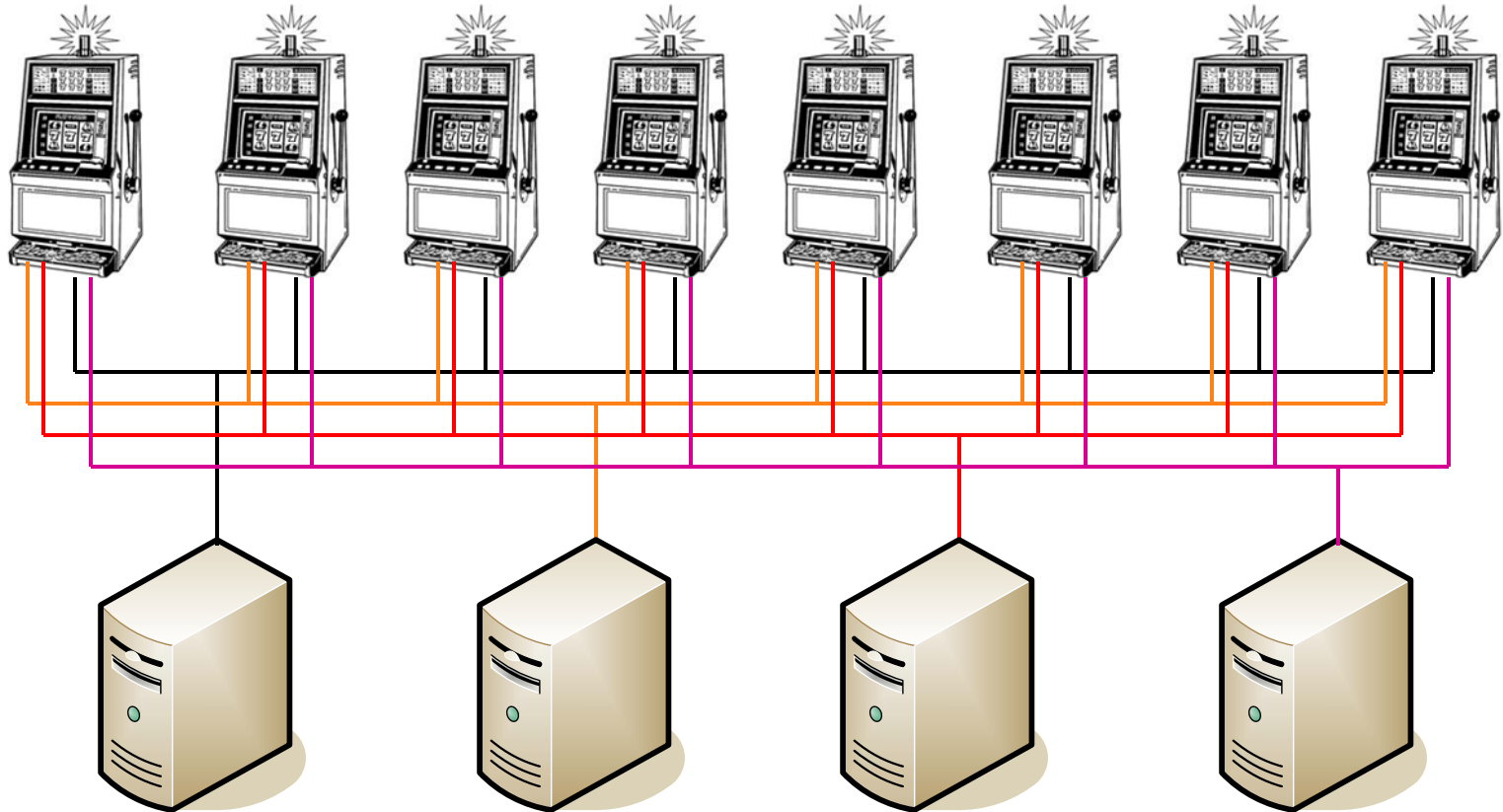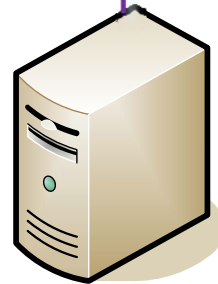
Slot Floor System Vouchers Analysis Bonusing

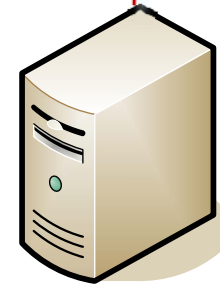# With G2S, there's a network on your floor!

Slot Floor System
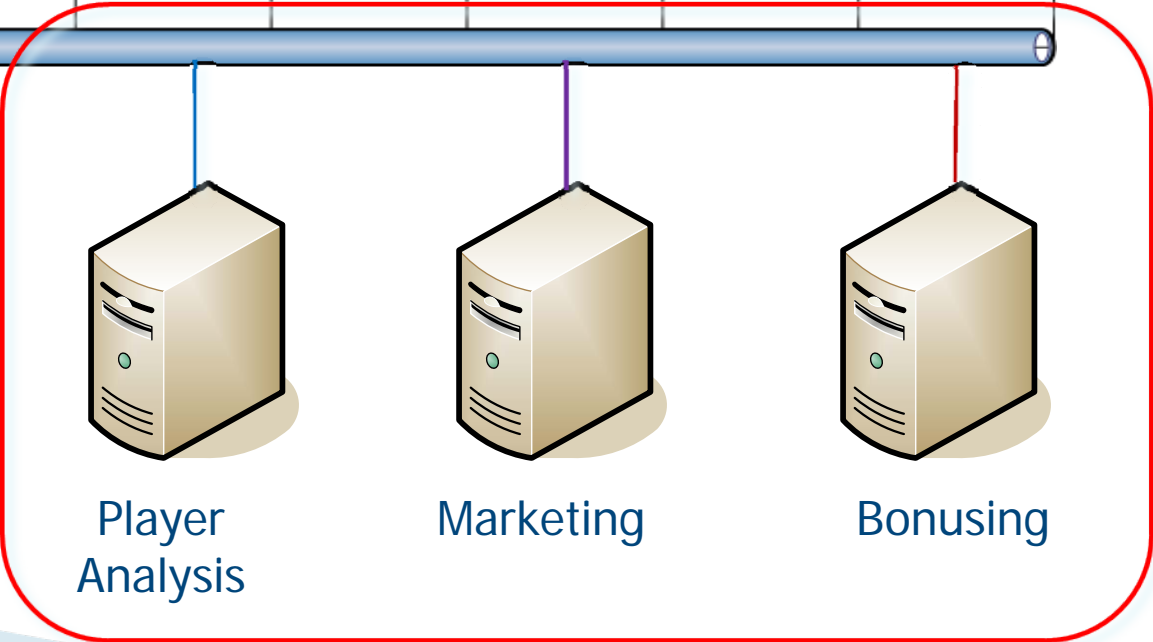
Player Analysis

Marketing

Bonusing

The Benefits of the Network

- Fast –50,000 times faster than SAS
- Uses standard Internet technologies
- Highly secure – same security as the Internet
- Off-the-shelf tools are available

- Network = 1 physical connection to the EGM
- Network = Each EGM can talk to lots of hosts
- <u>Six</u> Host connections should be the minimum

The Benefits of a Standard

- Standard protocol enables off-the-shelf development tools and discussion forums

- Allows for extensive testing
  - Protocol Simulators – basic communications
  - Test Tools – Test the "Edge" conditions
  - Load Testers – Explore a system's limits
  - Protocol Analyzer – The "Lie Detector"

- Independent Technology experts (RadBlue, GSA, Labs) – anyone can ask any question

The Benefits of G2S

>> Change=chaos
Is it worth it?

Lots of Change is Happening

- EGMs are being upgraded to handle G2S
  - High speed web-based communications
  - Lots of content moving to/from the EGM
  - Player peripherals move to the EGM
  - Rewriting 20 year old protocol stacks
  - Thinking of new features to make this compelling

- Systems are also being updated
  - Though less benefit to a Systems Manufacturer

Avoiding Chaos...

- G2S Protocol Spec contains lots of details
  - Message Layouts (plus schema)
  - Data model updates / Event Descriptions

- G2S Technical Committee is still active

- Develop against a Reference Implementation
  - SAS differences result from varied interpretations

- Large development/test teams (vs. SAS)

Avoiding Chaos…

▶ XML Validation

- The schema defines G2S
- Validation compares the G2S message against the schema to ensure it is "well-formed" and valid

▶ Message validation

- Descriptive tags must be correctly spelled
- Messages must be correctly formed
- Data must be valid as per the rules of the schema
  - Enumeration Lists (list of possible choices)
  - Data Formats (Date value must match a pattern)

Standard Tools and Techniques

- G2S is built on standards, so there are lots of libraries available
  - ◦ SOAP, SSL, XML Parsers, etc.

- Standard Tools are available to anyone
  - ◦ It's nice to have someone to talk to…
  - ◦ Result in testing during development
  - ◦ All messages are **validated** against the G2S schema

- Tools ramp up in complexity as the product matures

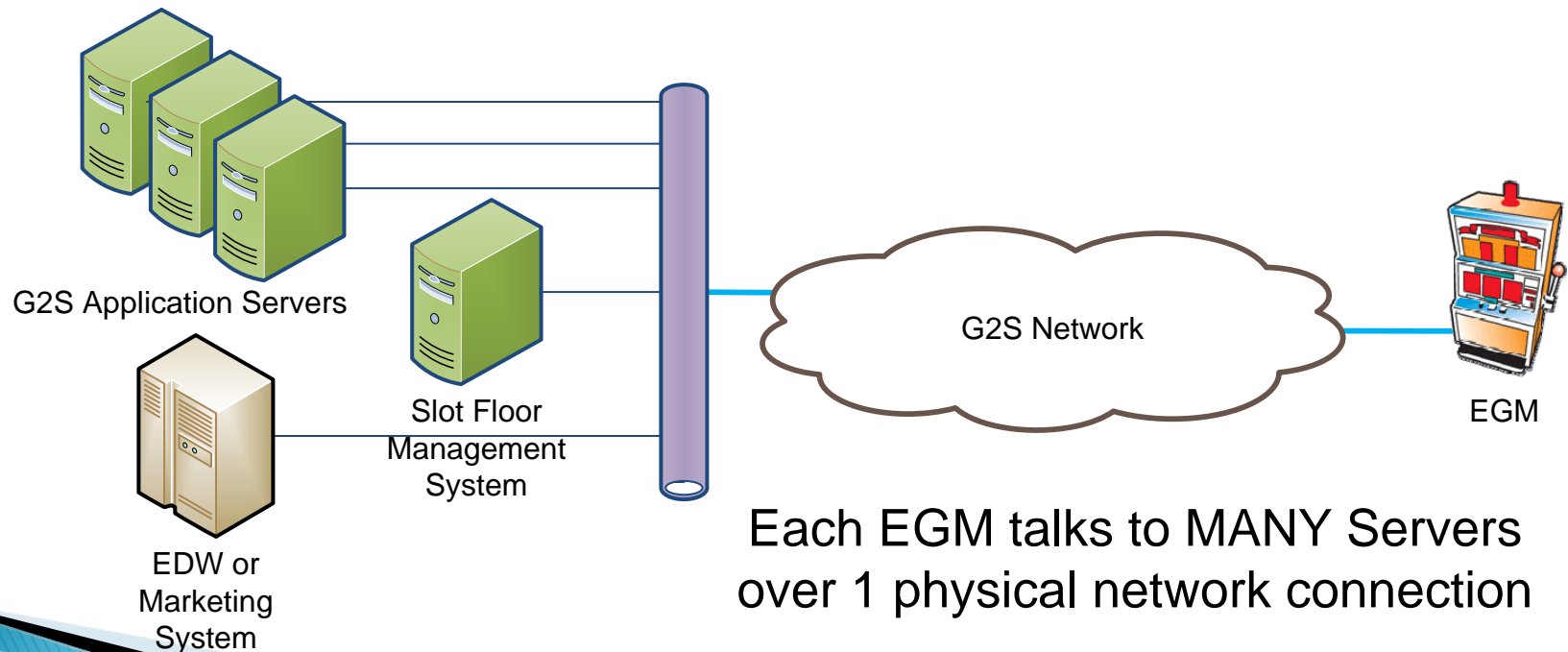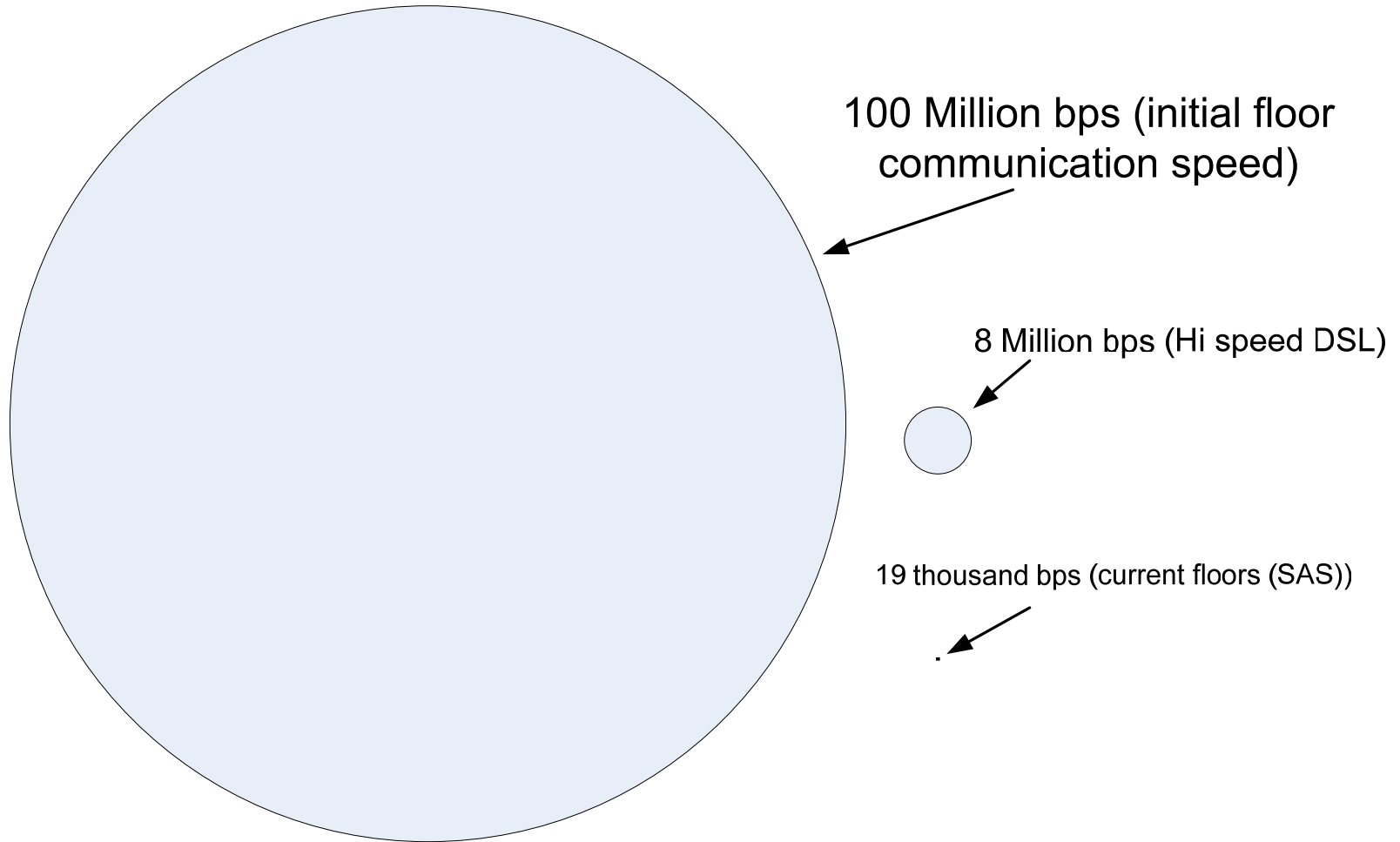# The Biggest Benefit

Internet to every EGM

- A world of possibilities opens up

- Take advantage of rich Internet tool-set

- First Apps are like e-mail on the Internet

- Start with Config and Download, but then...

Anyone Can Connect to the EGM

- Direct access to EGM means no reliance on middleware
- Regulators can have their own independent server
- To add functionality, just add another application

G2S Application Servers

EDW or Marketing System

Slot Floor Management System

G2S Network

EGM

Each EGM talks to MANY Servers over 1 physical network connection

No Traffic Jams…

100 Million bps (initial floor communication speed)

8 Million bps (Hi speed DSL)

19 thousand bps (current floors (SAS))

Network Backbone = 1-10 Billion bps

Securing the New Environment

>> Control in this new world…

Network Security

▸ Internet technology = robust internet security

▸ G2S uses off–the–shelf Internet solutions

▸ SSL/TLS – Prevents eavesdropping, tampering
  ◦ Only those with valid certificates can talk
  ◦ SCEP – automatic certificate issuance protocol
  ◦ OCSP – automatic publishing of revocation lists

▸ Managed networks (IPSec, etc.) are also fine

▸ Each EGM has list of registered Hosts

Real-time Program Protection

▸ GAT = Game Authentication Terminal class
  ◦ G2S – Used to validate software packages on EGM
  ◦ S2S – Used to validate packages on servers

▸ EGM's GAT Functions are consistent in all cases:
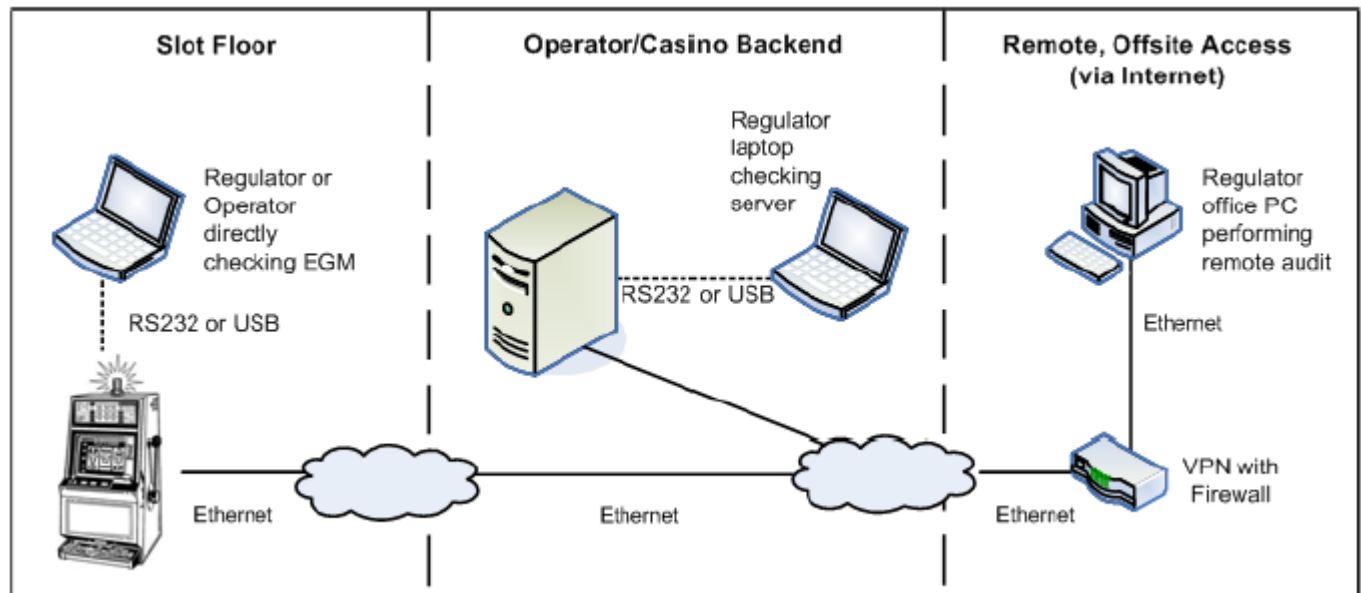
Real-time Program Protection

- Now – 10% of EGMs are checked each year

- With G2S GAT, software can be validated daily

- Supports CRC, MD5, and SHA signatures
  - (Whatever is supported by the EGM)

- With S2S - Verify packages on servers

- EGM signature = Server signature = Program signature from lab

Forensic Analysis

- Occasionally, things aren't quite right between EGM and SMIB

- With SAS – use a laptop running serial test
  - Requires access to EGM base for EGM to SMIB link
  - Must understand the Hex characters that are SAS

- With G2S, can use Protocol Analyzer (RPA)
  - Can be located anywhere on the network
  - Information is easy to understand
  - All messages are validated against the schema

Today's EGM Protocol (SAS)

```
HOST          82512218.8    01 6F 08 00 00 00 00 01 00 02 00 42 55
                            Send extended meters for game N: Game number 0000; Meters 0000, 0001, 0002;
EGM           82512239.1    01 6F 17 00 00 00 00 04 00 00 26 80 01 00 04 00 00 00 90 02 00 04 00 00 00 00 00 0C 9A
                            Send extended meters for game N: Game number 0000; Meters 0000=00002680, 0001=00000090,
                             0002=00000000;
HOST          82512259.6    81
                            General Poll
EGM           82512262.5    1F
                            No activity, waiting for user input
HOST          82512267.5    80
                            RESYNC
HOST          82512767.5    01 6F 08 00 00 00 00 01 00 02 00 42 55
                            Send extended meters for game N: Game number 0000; Meters 0000, 0001, 0002;
EGM           82512787.6    01 6F 17 00 00 00 00 04 00 00 26 80 01 00 04 00 00 00 90 02 00 04 00 00 00 00 00 0C 9A
                            Send extended meters for game N: Game number 0000; Meters 0000=00002680, 0001=00000090,
                             0002=00000000;
HOST          82512808.1    81
                            General Poll
EGM           82512810.1    1F
                            No activity, waiting for user input
HOST          82512815.1    80
                            RESYNC
HOST          82513315.1    01 6F 08 00 00 00 00 01 00 02 00 42 55
                            Send extended meters for game N: Game number 0000; Meters 0000, 0001, 0002;
EGM           82513334.7    01 6F 17 00 00 00 00 04 00 00 26 80 01 00 04 00 00 00 90 02 00 04 00 00 00 00 00 0C 9A
                            Send extended meters for game N: Game number 0000; Meters 0000=00002680, 0001=00000090,
```

[Looks like hex to me...]

A G2S Meter Request

Host Request

```
<getMeterInfo>
    <getDeviceMeters
        deviceClass = "G2S_noteAcceptor"
        deviceId = "1" />
</getMeterInfo>
```

EGM Response

```
<meterInfo
  meterSubType = "G2S_onDemand"
  meterDateTime = "2008-03-07T15:20:27" >
    <deviceMeters
        deviceClass = "G2S_noteAcceptor"
        deviceId = "1" />
    <simpleMeter
        meterName = "G2S_currencyInAmt"
        meterValue = "14000000" />
    <simpleMeter
        meterName = "G2S_currencyInCnt"
        meterValue = "14" />
    <simpleMeter
        meterName = "G2S_currencyToDropAmt"
        meterValue = "14000000" />
    <simpleMeter
        meterName = "G2S_currencyToDropCnt"
        meterValue = "14" />
    <simpleMeter
        meterName = "G2S_dropDoorOpenCnt"
        meterValue = "2" />
</meterInfo>
```

[A little easier to understand]

Forensic Analysis – RPA

Forensic Analysis – RPA

The Road to Aria

>> A case study of a successful G2S deployment

Overview

- Aria – first G2S casino
  - Opened in December 2009

- Success through collaboration
  - System Vendor and Operator first
  - RadBlue vets extensions and implements in Sims
  - EGM Developers implement G2S and extensions
  - Regulators, Test Labs to make sure all is ok

The Planning Game

- System Vendor and Operator agree on G2S

- NVGCB Lab is brought in early

- Operator and System Vendor decide on needed extensions for Aria

- IGT designs the extensions and schema

- RadBlue tests the extensions
  - IGT Extensions are added to the RadBlue Sims

Building the Solution

- System Development Begins

- Jan 2008 – Kick-off meetings
  - Sims with extensions are available to all parties
  - Standard Reference Implementation

- Labs start to prepare
  - Gaining knowledge
  - Assigning appropriate resources

- GLI gears up to review implementations
  - Independent testing experts

Testing the Solution

▸ Internal testing ramps up – all developers

▸ IGT opens GTIC in early 2009

▸ Those who were most serious about testing show up early and are most successful

▸ NVGCB discovers that GLI tested apps have least defects

Load Testing

- IGT – alpha site for our Load Tester
  - Goal was 2500 events <u>per second</u>
  - 2500 EGMs being played flat out for days on end

- Load Tester allowed sbX team to test with a whole floor of EGMs

- Load Balancer issues uncovered

- RLT – also used to validate the Aria network

Field Trial at Monte Carlo

- NVGCB insists on a field trial
  - Wring out new apps in a live environment

- EGM had to pass NVGCB review before joining the field trial

- Field Trial uncovered new issues
  - Only found after days of public play
  - Fortunately, before the Aria go-live

Aria Opening

- Aria opening was a great success

- Not too many "new" features
  - Just made sure the basics were exactly right

- Review of the new system environment
  - Nothing new
  - "somewhat boring"

- The first G2S floor – worked!

Soon: G2S in Your Casino

- G2S has had its debut
  - Now spreading around the world
  - Casinos and Lotteries

- Can start as small as one bank

- Spread across the floor as appropriate

- A "fearless" G2S install is coming soon to a casino near you…

New Protocols are Widely Accepted

EGM and System Developers

- Ainsworth Gaming
- Aristocrat Technologies
- Aruze Gaming
- Atronic
- Austrian Gaming Industries GmbH
- Bally Technologies
- International Game Technology (IGT)
- Intralot S.A.
- Konami Gaming
- Multimedia Games, Inc.
- Scientific Games International
- Shuffle Master Australasia
- SPIELO, a GTECH Company
- Techlink Entertainment
- Video Gaming Technologies, Inc. (VGT)
- WMS Gaming

Kiosks, G2S engines, and others

- Ameranth
- EDC ATM
- Global Cash Access
- Hermes SoftLab
- New Wave Automation
- Tech Results
- Videobet

Educational Groups

- Gaming Standards Association (GSA)
- GSA University
- Macau Polytechnic Institute

Testing Agencies

- BMM Compliance
- eclipse Compliance Testing
- Gaming Laboratories International (GLI)
- Missouri Gaming Commission
- Nevada Gaming Control Board

Operators

- British Columbia Lottery Corp.
- Isle of Capri Casinos
- Kerzner International

More information

GSA Resources (gamingstandards.com)

▸ Standards can be downloaded by anyone

RadBlue Resources

▸ Student Versions of our Sims (EGM, Host, RPA)

▸ Networked Gaming Resource Page @ radblue.com

▸ G2S Engine – roll your own application

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